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ABSTRACT

This study and analysis of the literature on the costs and benefits of graduate education (the GRADCOST study) is organized into 4 parts: (1) The Economics of Higher Education (Behavioral Models, Planning and Budgeting, the Financing of Higher Education); (2) Outputs and Benefits of Higher Education (Conceptual Literature, Measurements of Outputs and Benefits of Graduate Education); (3) Inputs and Costs (Conceptual Literature, Cost Structure Models); and (4) Inputs and Cost-Measurement (Direct Cost Studies, Full Cost Studies). (Author/CS)

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AN ANNOTATED BIBLIOGRAPHY OF LITERATURE RELATING TO THE COSTS AND BENEFITS OF GRADUATE EDUCATION

By

John H. Powel, Jr., and Robert D. Lamson

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HE 003 543

THE COUNCIL OF GRADUATE SCHOOLS IN THE UNITED STATES

THE NATIONAL ASSOCIATION OF COLLEGE AND UNIVERSITY BUSINESS OFFICERS

Funded in Part by the National Science Foundation, Grant No. GR 80, Awarded to the Council of Graduate Schools
April 30, 1970

The Council of Graduate Schools / Washington, D.C. / March 1972

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Inquiries concerning additional copies of this and companion documents should be addressed to The Council of Graduate Schools in the United States 1 DuPont Circle, Washington, D. C., 20036

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FOREWORD

This study and analysis of the literature relative to the costs and benefits of graduate education (the GRADCOST study) was begun as a result of a resolution passed in December, 1968 at the Annual Meeting of the Council of Graduate Schools in the United States (CGS). Shortly thereafter, discussions were undertaken with representatives of the National Association of College and University Business Officers (NACUBO) and it was agreed to proceed with a study under joint sponsorship. This paper sets forth part of the results arising from this study.

A Joint Gradcost Committee was appointed by the officers of CGS and NACUBO, which also included representatives of the National Academy of Sciences and the Western Interstate Commission on Higher Education. Meetings were held in May, July, October and December of 1969 at which the Joint Committee concluded that a study and an analysis of the literature should be carried out as the first step toward securing the information needed in the field. On April 30, 1970, the National Science Foundation granted $78,000 to the CGS to assist in paying the costs of the study.

The study itself has been carried out by the Gradcost Research Group, which has worked in Seattle under a subcontract between the CGS and the University of Washington. Personnel were: Dr. Joseph L. McCarthy (Director), Mr. James F. Ryan, (Co-Director), Dr. Robert D. Lamson (Project Coordinator), Mr. John H. Powel, Jr. (Research Analyst).

The collection of the literature and the development of concepts for the analysis and reporting of results were performed by Dr. Robert D. Lamson and Mr. John H. Powel, Jr. The results of their analysis are presented in two parts:

Elements Related to the Determination of the Costs and Benefits of Graduate Education by John H. Powel, Jr. and Robert D. Lamson.

An Annotated Bibliography of Literature Relating to the Costs and Benefits of Graduate Education by John H. Powel, Jr. and Robert D. Lamson.

Major credit belongs to Mr. Powel for organizing and reviewing most of the massive body of literature covered, and especially for developing the conceptual framework used to analyze cost studies. The authors also assumed responsibility for coordination of this effort with the Cost Finding Principles Project now underway at the National Center for Higher Education Management Systems at the Western Interstate Commission for Higher Education. The contributions of these authors are greatly appreciated.

While the publication of these two papers concludes the joint effort of the CGS and NACUBO, it is clear that the existing literature leaves some of the most important questions which prompted the study unresolved. Among the problems unanswered are:

1. Adequate identification of the outputs and benefits of graduate education.
2. Agreement on how separately budgeted research and financial aid should be treated in determining the costs of graduate education.
3. Lack of a definitive and generally accepted set of procedures for allocating indirect costs to the outputs of graduate education.
4. Lack of comparable data on a broad basis as to the actual costs of graduate education.

These unanswered questions and unresolved issues lie at the heart of the problems besetting graduate education and should be the subject of continuing research, even though definitive answers and solutions may not be in the immediate offing.

It should be pointed out that the National Center for Higher Education Management Systems at WICHE is presently conducting empirical research on many of the unanswered questions listed above through projects dealing with cost finding principles, models for interinstitutional exchange of information, and measurement of the outputs of higher education.

As a more immediate commentary, Deans Joseph L. McCarthy and David R. Deener have authored a position paper which presents an alternative view of some of the issues raised in the literature and includes their recommendations on some key points. Their efforts are presented in a separate report sponsored by the CGS alone:

The Costs and Benefits of Graduate Education: A Commentary with Recommendations by Joseph L. McCarthy and David R. Deener.

It is recognized that this paper may not represent the views of some segements of the higher education community. In particular, it should be noted that the National Association for College and University Business Officers is not associated with this effort.

The Joint Gradcost Committee (listed below) has given substantial help to the Gradcost Study by providing general guidance and by reviewing drafts of the papers and reports. The contributions of the Joint Committee, and particularly the Steering Committee, are deeply appreciated, although they cannot be held responsible for the specific contents of the papers resulting from the study.

JOINT GRADCOST COMMITTEE

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State University System of Florida

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University of Missouri (now University of Wisconsin)

Robert H. Wessel
University of Cincinnati

Close communication has been maintained with representatives of the National Science Foundation and the advice and aid provided by Justin C. Lewis and Felix H. I. Lindsay, Study Director and Associate Study Director, respectively, of the Science Education Studies Group, and also Charles Falk, the Planning Director, have been very helpful.

Finally, appreciation is expressed to the graduate deans, financial affairs officers, faculty, students and public officials of the nearly 400 institutions and organizations who gave help and advice, and especially to the members of the Executive Committee of the CGS and the NACUBO for their continuing encouragement and support.

We hope and expect that the results of this study will be found useful by officers, faculty and students of colleges and universities in the United States, by representatives of government agencies, foundations, private donors, and indeed, citizens who are concerned with graduate education.

The Joint CGS-NACUBO Steering Committee

Kenneth D. Creighton
Paul V. Cusick
David R. Deener
Joseph L. McCarthy
J. Boyd Page
James F. Ryan

March, 1972

ACKNOWLEDGMENT BY THE AUTHORS

The authors wish to express their gratitude to the full GRADCOST Committee and the Steering Committee upon whose initiative this study developed, and whose active support, supervision, and discussions were invaluable throughout the course of the research. We would especially like to thank the directors of the project, Dr. Joseph L. McCarthy and Mr. James F. Ryan, for their careful attention and constructive criticisms which guided us during the project.

In addition, the authors wish to acknowledge the following contributions: During the course of the study through several lengthy discussions and reviews many helpful comments were received from Mr. Michael E. Young and Mr. Gordon Ziemer of the National Center for Higher Education Management Systems at the Western Interstate Commission for Higher Education. Editing of penultimate drafts, including the tracking down of countless fugitive sources and incomplete references, was performed by Dr. Barbara Howard. Also, gratitude is due Ms. Valerie Nelson whose diligent efforts in maintaining the extensive files of literature, working papers, and correspondence and whose conscientious respect for deadlines in the preparation of and distribution of working papers and chapter drafts to the committee were vital to the successful completion of the project.

Finally, the authors are indebted to the several individuals in various administrative and academic capacities at institutions throughout the country who took the time to review and comment on various drafts of these documents.

Robert D. Lamson
John H. Powel, Jr.

Seattle, Washington
September, 1971

1. THE ECONOMICS OF HIGHER EDUCATION

Sources included in this section are representative of those which the authors found helpful for understanding the general background and economics of decision making in higher education. Sources have been grouped under four sub-headings, Behavioral Models, Planning and Budgeting, Financing of Higher Education, and Other. The first sub-heading, Behavioral Models, contains sources which attempt to describe the objectives and incentive structures within institutions of higher education, and from these to derive testable behavioral predictions. The second sub-heading, Planning and Budgeting, refers to both internal and external (for public institutions) budgetary processes which are amply described in the literature. The third sub-category, Finance of Higher Education, consists of sources which describe the mechanics and equity of current funding arrangements for higher education, as well as possible alternatives. The last category contains general references dealing with other aspects of the economics of higher education.

1.1 Behavioral Models

Black, Guy. "The Basic Financial Model of the University." Draft and Appendix A to "A Project to Establish Program Budgeting at The George Washington University," Annual Report on Ford Foundation Grant, No. 690-0224, March 1970. Washington, D. C. (Unpublished)

A conceptual discussion of objective functions of institutions of higher education. Using diagrammatics and some basic economic concepts, the author compares on a conceptual level the pricing and output behavior of a typical institution of higher education with pricing and output behavior that might be considered socially ideal. In the appendix the author explores the hypothesis that the university operates as a cartel, seeking a tuition and scale which maximizes net return, and then distributes that return to the members of the cartel in the form of enhanced income, or reduced work assignments.

Breneman, David W. *An Economic Theory of Ph.D. Production*. Paper No. P-8, Ford Foundation Research Program in University Administration. Berkeley: Office of the Vice President--Planning and Analysis, University of California, June 1970.

On the basis of preliminary data, the author develops the hypothesis that high success rates of Ph.D. aspirants occur in physical and biological sciences but not in other discipline areas. The author develops a theory of departmental behavior to be tested

on the basis of these observations. Faculty members are assumed to behave according to the theory of utility maximization which may be translated in terms of prestige maximization. Prestige is defined in terms of resources employed and placement of Ph.D. students in high quality jobs. Variables under departmental control are admissions policy, curriculum design, information flow, and organization of resources for financial support. The author's hypothesis is that the demand for graduate students by department is a derived demand from its prestige objective function.

Breneman, David W., and Weathersby, George B. "Definition and Measurement of the Activities and Outputs of Higher Education." Discussion Paper No. 10. Berkeley: University of California, August 1970. (Unpublished)

The authors examine deficiencies in current incentive structures in institutions of higher education and call for the use of output measures in restructuring incentive systems as a much needed reform for higher education.

Cartwright, Philip W. "The Economics of Deaning: The Care and Feeding of Homo Academicus: A Sketch of University Decision-Making," *Western Economic Journal*, Vol. III, No. 2, Spring 1965, pp. 52-4.

A discussion of the nature of objective functions in higher education management. The author suggests that prestige maximization is the best description of behavior of university managers and that prestige is defined in terms of public research, graduate instruction, undergraduate instruction, and community service. Since there are no objective prices for these various outputs, the successful administrator is one who correctly assesses the relative contributions of each to the prestige of his institution. In order to maintain prestige,says the author, administrators must be careful to pay in terms of monetary and non-monetary benefits the individuals involved in producing these outputs an amount which is no greater than the value of their contribution to prestige and no less than their alternative contribution at some other institution. The author calls this aspect of personnel policies the practice of price discrimination across disciplines and levels.

Fouraker, L. E. "Trouble in the Technique Industry," *The Journal of Business*, Vol. 32, No. 4, October 1959, pp. 327-39.

A summary economic analysis of higher education, which the author claims is troubled by a growing disequilibrium. The author characterizes this disequilibrium as an excess demand for services of academic personnel which is aggravated by a secular decline in the real income of these personnel. The author explains this disequilibrium in the following manner: Funders of higher education are willing to accept inappropriate application of the analogy of business operations to higher education. Supervisory personnel in business are paid more than those supervised. Application of this principle by analogy to higher education results in an unwritten economic law that administrators must be paid more than faculty members. This results in an arbitrary ceiling on faculty salaries which prevents equilibrium in the academic labor market. The article also contains an interesting digression on the sociological role of education.

Freeman, Roger A. "The Labor Market for College Manpower." Unpublished Ph.D. Dissertation. Cambridge, Massachusetts: Department of Economics, Harvard University, 1967.

A model of the supply of college graduates to various careers. Career choice is described as indivisible, being a once in a lifetime decision which prevents learning from any previous decisions. A cobweb model is used to explain market dynamics. Profitability of investment in the Ph.D. is compared for various fields. Expectations of graduates are examined for consistency across fields on the basis of survey data.

Niskanen, William A. "Bureaucracy and Representative Government, A Review Draft." Arlington, Virginia: Institute for Defense Analyses, February 1970. (Unpublished)

In this preliminary version of a book yet to be published, the author investigates the behavior of economic units providing public goods or services, i.e., those for which the consumer is not the source of financing. The author defines such units as bureaus, which trade expected output levels for budget levels, typically in a bilateral monopoly relationship. The author then describes the incentive structure which this kind of organizational setting creates and the behavioral consequences in terms of input levels and mixes and output levels which follow from such incentive structures.

Public Policy Research Organization. *More Scholars Per Dollar.* Report Prepared for the Ford Foundation and Carnegie Commission on Higher Education. Irvine: University of California, February 1, 1971.

A comparison of 18 possible changes which might improve the allocation of resources in higher education. The changes range from various kinds of administrative reorganization to direct student funding, as opposed to institutional funding.

1.2 Planning and Budgeting

Anderson, D. R., and Duren, William L. "Are There Too Many Ph.D.'s?" *American Math Monthly*, June-July, 1970, pp. 626-40.

The authors predict an oversupply of Ph.D.'s in Mathematics. Several reasons for this are cited and recommendations are made for dealing with the situation.

Astin, Helen S. "Factors Associated With the Participation of Women Doctorates in the Labor Force." U. S. Department of Labor, *Personnel and Guidance Journal*, n.d.

This study investigates employment status and career commitment of women doctorates in order to identify personal and environmental factors associated with labor force participation of women doctorates. Among the findings: (1) 81 per cent of the sample are employed full time; (2) greatest attrition of women from the labor force is through marriage and from natural science disciplines--Humanities and Education have the highest rate of full-time employment; (3) full-time employment of women is positively correlated with

receiving the Doctorate after marriage instead of before; (4) women who marry lawyers, businessmen, and social scientists are more inclined to work full time; (5) women doctorates who work full time are more likely to be engaged in research or administrative activities and to be employed by governmental agencies.

Bolt, Richard H.; Koltun, Walter L.; and Levine, Oscar H. "Doctoral Feedback into Higher Education," *Science*, Vol. 148, May 14, 1965, pp. 918-27.

An attempt is made to develop a tool to help policy makers see the likely consequences of program additions. The process of degree production is represented by means of a feedback model that abstracts in functional form certain quantitative elements of the process. After analyzing the model dynamically, the authors graph the results to depict alternative policies as alternative paths are drawn from a point. Although the analytical model is applicable to the production of degrees at any academic level, it is applied only to degrees at the doctoral level, in the fields of science and engineering.

Cartter, Allan M. "The Supply of and Demand for College Teachers," *Journal of Human Resources*, Vol. I, No. 1, 1966, pp. 22-38.

In this article the author predicts that the seller's market for college faculty will quickly disappear in the early 1970s. If the demand for new doctorates in teaching stabilizes or declines after 1968 as a consequence of the declining rate of growth of the total system, then a serious question of public policy, says the author, may be whether or not it is desirable to encourage many new institutions to enter the doctoral field.

Danière, Andre L. "Planning Education for Economic Productivity." In Seymour Harris, *Challenge and Change in American Education*, pp. 205-20. Berkeley: McCutchan Publishing Corporation, 1965.

The paper deals with two problems. First, problems in evaluating the contribution of education to the economy's measured national product is discussed with reference to the recent attempts by Theodore Schultz. Second, the author proposes criteria for an optimal allocation of national resources to education from the viewpoint of technological productivity. Basically, the approach used in this section is an input/output planning model. Current growth trends and training requirements of industries are used to predict future training requirements.

Folger, John K. "The Balance Between Supply and Demand for College Graduates," *Journal of Human Resources*, Vol. 2, No. 2, Spring 1967, pp. 143-64.

One of the few authors, including Dr. Allan Cartter, who predicted doctorate oversupply in the 1960s. The article outlines three possible responses to oversupply: (1) modify the doctorate to respond more to current needs; (2) limit output by raising quality standards; (3) do nothing and wait for the experiences of unemployed Ph.D.'s to act as a thermostat to lower the supply of doctoral aspirants to graduate schools. The latter alternative, according to the authors, is the one which appears to be the current course.

Folger, John K.; Astin, Helen S.; and Bayer, Alan E. *Human Resources and Higher Education.* Staff Report of the Commission on Human Resources and Advanced Education. New York: Russell Sage Foundation, 1970.

This source surveys current supply and demand on a national level in order to predict the fields in which an imbalance is likely to occur. Authors predict that over supply is most likely in creative arts and less likely in engineering, law, medicine, nursing and social welfare work. In general, the authors predict lower employment of graduate degree recipients within higher education, more selective faculty appointments, more hiring of doctorates as opposed to Master's degree recipients. Finally, several criteria for public policy decision making are enumerated.

Green, John L., Jr. *Budgeting in Higher Education.* Athens: University of Georgia Business and Finance Office, University Bookstore, 1971.

A very broad study which touches briefly on almost every conceivable aspect of budgeting in higher education at the institutional level.

Halpern, Jonathan. *Bounds for New Faculty Positions in a Budget Plan.* Paper P-10, Ford Foundation Research Program in University Administration. Berkeley: Office of the Vice President--Planning and Analysis, University of California, May 1970.

"This paper formulates and solves a mathematical model used to calculate lower and upper bounds on the number of new faculty positions allocated, over a finite planning horizon, to a multi-campus educational institution. In this model the student faculty ratios must meet certain growth rate restrictions imposed by the faculty and the administration. The initial student/faculty ratios, forecasts of student enrollments and certain critical ratios are assumed known and given."
(From the author's Preface, page i.)

Hamelman, Paul W. *Planning and Analysis for Higher Education: Promises and Pitfalls.* Paper presented at the Joint National Meeting of the Operations Research Society of America and the American Astronautical Society, "Planning Challenges of the 70s in Space and Public Domain," June 1969. Blacksburg: Virginia Polytechnic Institute, 1969.

This study generalizes the production function concept of higher education from small colleges to complex multi-universities. The author discusses the problem of choosing an appropriate mix among alternative combinations of educational objectives. Examples of two simulated cases using alternative assumptions are given to illustrate the problem. The author also discusses pros and cons of using planning-programming-budgeting analysis or the production function approach to educational planning and analysis.

Hansen, W. Lee, and Weisbrod, Burton A. *Benefits, Costs, and Finance of Public Higher Education.* Markham Series in Public Policy Analysis. Chicago, Illinois: Markham Publishing Company, 1969.

Chapter I is a well-written and easily understood introduction to the economics of higher education which covers most of what economists have to say about the subject. Remaining chapters are estimates of benefits and costs and their distribution in California. The study concludes with discussions of alternative financing schemes and recommendations for further research.

Harman, W. G. "Three Approaches to Educational Resource Allocation." Working Paper Series, No. 6904. Toronto, Ontario, Canada: Institute for the Quantitative Analysis of Social and Economic Policy, University of Toronto, December 1968. (Unpublished)

A survey of three approaches to planning: social demand estimation, manpower forecasting, and cost benefit analysis. The survey includes discussion of techniques used by Denison, Becker, and Schultz, among others, for developing quantitative basis for policy decisions concerning higher education resource allocation.

Leimkuhler, Ferdinand F., and Cooper, Michael D. *Analytical Planning for University Libraries.* Paper P-1, Ford Foundation Research Projects in University Administration. Berkeley: Office of the Vice President--Planning and Analysis, University of California, January 1970.

An exploratory study of the problems in library planning. Provides an assessment of the current state of the art in library planning and identifies promising directions for the development of planning criteria and techniques of analysis. Use of operations research models of acquisition and storage functions and elementary models of circulation are used to show how storage costs of service can be minimized.

Mayhew, Lewis B. *Graduate and Professional Education, 1980: A Survey of Institutional Plans.* An essay written for The Carnegie Commission of Higher Education. Hightstown, New Jersey: McGraw-Hill Book Company, 1970.

Summary and discussion of the results of a survey of several institutions of higher education with regard to planned output levels. The author describes what appears to be a persistent belief on the part of institutional leaders that shortages will persist in all save a few fields well into the 1970s and probably beyond, which will be accompanied by rising faculty salaries and an increasing portion of time spent on research. The author points out that this belief seems to persist in spite of evidence which implies an actual over supply of Ph.D.'s in the 1970s at current salary levels. Institutional expectations are generally described as continued growth of both capital and operating expenditures (with operating budgets doubling or tripling over the decade of the 70s).

Miller, James L., Jr. *State Budgeting for Higher Education: The Use of Formulas and Cost Analysis.* Michigan Governmental Studies No. 45. Ann Arbor: Institute of Public Administration, University of Michigan, 1964.

A thorough study of the history of formula budgeting in American institutions of higher education with specific references to the factors involved in development of formulas and description of the manner in which they are used, along with contingent problems and inequities which have resulted.

Millett, John D. *Planning, Programming and Budgeting for Ohio's Public Institutions of Higher Education*. Columbus: Ohio Board of Regents, May 1970.

A comprehensive framework for budgeting and accounting by public institutions of higher education in Ohio. Outputs, activities, and program aggregations useful for creating an output-oriented budgetary process are described in detail. The author chooses a three-level system of aggregation: the operations level, which describes individual offices and activities; the program level, which consists of aggregations of individual offices and activities into schools and colleges; and the enterprise level, which comprises the entire university. Each level has systems which are unique to it. In addition to the conceptual outline of the proposed system, plans for implementation are also given.

Minter, John, and Lawrence, Ben, eds. *Management Information Systems: Their Development and Use in the Administration of Higher Education*. Boulder, Colorado: Western Interstate Commission for Higher Education, October 1969.

Nine papers from the Seminar on the Advanced State-of-the-Art, The Sterling Institute, Washington, D. C., April 24-26, 1969, Sponsored by the Western Interstate Commission for Higher Education and the American Council on Education.

". . . the seminar brought together users and developers of analytical models and their associated management information systems in higher education institutions and agencies who reviewed and commented on prepared papers and discussed critical state-of-the-art questions." (From the Foreword, page iii.)

Morrell, L. R. "Financial Considerations for the Private Liberal Arts College." Amherst: Office of Budgeting and Institutional Studies, University of Massachusetts, July 1, 1970. (Unpublished)

Draft of a chapter to be included in a forthcoming book published by the Jossey Bass Company. Discussion of the need for and procedures involved in instituting program budgeting or output-oriented budgeting in cost accounting in institutions of higher education.

Oliver, Robert M. *An Equilibrium Model of Faculty Appointments, Promotions, and Quota Restrictions*. Research Report No. 69-10, Ford Foundation Research Program in University Administration. Berkeley: Office of the Vice President--Planning and Analysis, University of California, March 1969.

"In this study, the author attempts to identify feasible new appointment schedules for a large tenure and nontenure faculty group in which quota restrictions have been applied to the total number of faculty appointments. It is assumed the system is in equilibrium in the sense that the flow rate of new appointments is equal to the sum of resignation, retirement, and death rates." (From the author's Abstract, page i.)

Oliver, Robert M. *Models for Predicting Gross Enrollments at the University of California.* Research Report No. 68-3, Ford Foundation Research Projects in University Administration. Berkeley: Office of the Vice President--Planning and Analysis, University of California, August 1968.

> "The purpose of this report is to discuss and compare two mathematical models for predicting student enrollments at the University of California. One has already been proposed in the scientific literature . . . the second used by the State of California. . . . since 1963 to forecast student enrollments. . . . The specific problems that we address in this report are the prediction of gross enrollments, i.e., freshmen, sophomores, etc., for a particular campus or the University as a whole. Although we restrict our experimental data to undergraduates, the discussion and conclusions are probably appropriate to graduate levels as well." (From the author's introduction, pages 1 and 2.)

Pinnell, Charles, and Wacholder, Michael. *Guidelines for Planning in Colleges and Universities.* Vol. One - Planning System. College Station: Texas A & M University, January 1968.

_____. *Guidelines for Planning in Colleges and Universities.* Vol. Two - Management and Financial Planning. College Station: Texas A & M University, July 1968.

_____. *Guidelines for Planning in Colleges and Universities.* Vol. Three - Physical Plant Planning, Land Use and Traffic College Station: Texas A & M University, July 1968.

_____. *Guidelines for Planning in Colleges and Universities.* Vol. Four - Physical Plant Planning, Facilities Studies. College Station: Texas A & M University, July 1968.

_____. *Guidelines for Planning in Colleges and Universities.* Vol. Five - Physical Plant Planning, Utilities Studies. College Station: Texas A & M University, May 1968.

The five volumes in this set comprise comprehensive planning guidelines for higher education. Each volume deals with a specific aspect of planning and gives both general guidelines and detailed recommendations for implementing all aspects of the planning process. According to the State Coordinating Board of the Texas College and University System:

> "The process of planning described in these volumes focuses on the creation of a system to permit institutions to identify that which is innovative and unique about their educational program and objectives and to plan in depth within the context of their institutional objectives. Master planning is conceived in these volumes as encompassing the total

decision-making framework of the institution. Under such a condition, an institutional master plan becomes a complex document in which the design and location of buildings is but one of the components." (From Vol. One, page iii.)

"Planning--Programming--Budgeting Systems: A Symposium," *Public Administration Review*, Vol. XXVI, December 1966, pp. 243-310.
A summary of the history leading to and the techniques currently employed in this general area.

Reed, Bevington [Chairman]. *Designation of Formulas*. (Adopted: February 6, 1970). Austin, Texas: The Coordinating Board, Texas College and University System, June 1970.
An example of formula budgeting procedures used by state coordinating boards.

Van Wijk, Alfons P.; Judy, Richard W.; and Levine, Jack B. "The Planning Programming Budgeting System in Universities." A paper presented at The Institute of Management Science Meetings, Atlanta, Georgia, October 2, 1969. Toronto, Ontario, Canada: The Institute for Policy Analysis, University of Toronto and Systems Research Group, n.d. (Unpublished)
Part 1 deals with the history and past experience of program budgeting at American and Canadian universities. In part 2, the budgetary cycle in typical universities is outlined as consisting of four stages: planning and analysis, program definition and budgeting, management of actual operations, and reporting and control. Part 3 discusses the design implementation of a program budgeting system. The report concludes with a discussion of problems inherent in implementing the changes outlined.

Van Wijk, Alfons P., and Levine, Jack B. "The Pros and Cons of Existing Formula Financing Systems and a Suggested New Approach." A paper presented at the Colleges of Applied Art and Technology Design Workshop, Ottawa, November 18, 1969. Toronto, Ontario, Canada: The Institute for Policy Analysis, University of Toronto, and Systems Research Group, n.d. (Unpublished)
The authors discuss the advantages and disadvantages of two types of formulas used in higher education budgeting. First, the authors describe the "base formula," which measures direct expenditures and allocates overhead using direct expenditures or parts thereof as a base. The second type of formula is the functional formula, which identifies separate variables with which different types of expenditures are correlated. Examples of each type of formula are given. Finally, the paper proposes use of a simulation model which is similar to the functional type of formula in that variable aspects of all parts of the university system are considered, but differs from the formula approach in that interrelationships between the various aspects of this system are also taken into account.

Walton, J. P. *An Analysis of the Methods Utilized by State Boards Governing Multiple Institutions of Higher Education in the Distribution of Current Operating Funds Under Their Control.* Ann Arbor, Michigan: University Microfilms, 1967.

"The purpose of this study is to identify and analyze the methods state boards of institutions of higher education use in distributing state funds to the several institutions under their control and to ascertain the similarities and dissimilarities appearing in the methods. An outcome expected from the study is the determination of a procedure which may serve as a guide to boards of state institutions of higher education in the distribution of state funds or in establishing a pattern for the distribution of funds." (Chapter 1, page 5.)

Chapter III contains a list of states with coordinating boards responsible for multiple institutions and identifies those which are charged with allocating funds.

Chapter IV contains an analysis of formulas utilized.

1.3 The Financing of Higher Education

Balderston, F. E. *The Repayment Period for Loan-Financed College Education.* Paper P-15, Ford Foundation Research Projects in University Administration. Berkeley: Office of the Vice President--Planning and Analysis, University of California, January 1970.

The author demonstrates mathematically that shifting from a grant to loan financing system for students lengthens the time before a graduate breaks even. The implication is that all loan financing for which the repayment is concentrated in the earlier years of working life has some deterrent effect upon college attendance because the net payoff is concentrated in the later part of working life. Since short amortization periods impose heavy burdens of cash outflow on the student and since expectations are not always correct, the author urges that loan financing of higher education be tempered by spreading risks and basing repayment on contingent income or providing for some kind of forgiveness arrangement to compensate insofar as possible for the following considerations: (1) pessimistic future income forecasts; (2) probabilistic events such as illness and disability; (c) the choice of socially valuable but low-income occupations at the time of the occupational decision after college is completed (and this might include the choice of child-bearing and child-rearing for women); and (d) the presence of high discount rates among some students.

Bolton, Roger E. "The Economics and Public Financing of Higher Education: An Overview," *The Economics and Financing of Higher Education in the United States*. (U. S. Congress, Joint Economic Committee), pp. 11-107. Washington, D. C.: U. S. Government Printing Office, 1969.

The report covers: (1) recent statistical trends related to higher education in the United States; (2) total social costs and benefits of higher education, their components, and problems involved in measuring them; (3) a discussion of education from the investment point of view; (4) the question of the volume and form of public aid; and (5) discussion of alternative public programs.

Bowen, Howard R. "The Financing of Higher Education: Issues and Prospects," *The Future Academic Community--Continuity and Change*, pp. 205-19. Edited by John Caffrey. Washington, D. C.: American Council on Education, 1969.

An outline of some of the major issues and choices involved in financing higher education. The author predicts stiffer competition for educational funding and a changing pattern of support. In particular the author predicts an increased share of financing by the federal government and a decr ased share by private sources and state and local governments. Diversity of sources of funds, says the author, means diverse clients and an increasing diversity in the nature of outputs produced for higher education.

Cagle, Fred R. *Federal Research Projects and the Southern University*. Atlanta, Georgia: Southern Regional Education Board, 1962.

This document represents an investigation of problems created by federal funding of project research, reaction of universities to these problems, and recommendations based on review of published information, correspondence, and interviews. The author makes eighteen recommendations for universities, sixteen recommendations for the federal government, three for the Southern Regional Education Board, and three for national organizations representing universities. The report also provides a brief history of federal research support in higher education.

Carnegie Commission on Higher Education. *Quality and Equality: New Levels of Federal Responsibility for Higher Education*. A special report and recommendations of the Commission. Berkeley, California, December 1968.

A comprehensive study of American needs and expectations from higher education, the sources of funds available to meet them, and a comparison of these with rising costs. The study recommends grants and loans to individual students in order to provide equitable distribution of educational opportunity. It also recommends institutional support to meet the increased costs of expanding enrollment in areas of national concern, and extension of federal support for research and construction. With respect to graduate education the study recommends broader grant and loan support for students, loan costs to be tied to federal borrowing costs in order to make loan programs self-sustaining. Overall total costs of the various programs recommended would be $7 billion in 1970-71 and $13 billion by 1976, as compared with current (1968) programs of about $3.5 billion.

Clurman, Michael. "Does Higher Education Need More Money?" *Economics and Financing of Higher Education in the United States.* (U. S. Congress, Joint Economic Committee), pp. 632-51. Washington, D. C.: U. S. Government Printing Office, 1969.

The author suggests that higher education has reached the point where the volume of financing is less important than the manner in which it is administered. Decentralization of aid-giving may be a feasible alternative.

Cook, Gail C. A., and Stager, David A. A. *Student Financial Assistance Programs.* Toronto, Ontario, Canada: Institute for Quantitative Analysis of Social and Economic Policy, University of Toronto, November 1969.

A comprehensive study of the alternative financing schemes available in theory as well as in operation. While not advocating any one procedure, the foreword to the study speaks most favorably of loan-financed full cost tuition charges subject to a contingency feature which allows risk sharing.

Friedman, Milton. "The Higher Schooling in America: A Symposium on Financing for Higher Education," *The Public Interest,* No. 11, Spring 1968, pp. 108-12.

This outspoken proponent of free market solutions to most economic problems criticises the subsidy approach to financing higher education. Effective resource allocation and equity are both served, claims the author, by relying on full cost tuition charges and loan financing.

Hansen, W. Lee, and Weisbrod, Burton A. "The Search for Equity in the Provision and Finance of Higher Education," *Economics and Financing of Higher Education in the United States.* (U. S. Congress, Joint Economic Committee), pp. 107-23. Washington, D. C.: U. S. Government Printing Office, 1969.

A discussion of the equity or lack of it involved in subsidy financing of higher education. While some low-income persons have benefited handsomely from the availability of publicly subsidized higher education, on the whole the effect of these subsidies, say the authors, has been to promote greater rather than less inequality among people of the various social and economic backgrounds. One of the chief problems is that many subsidies are made available in such a way that lower income families are either not eligible for them or cannot make use of them because of the conditions and constraints associated with their income position.

Harris, Seymour Edwin. *Higher Education: Resources and Finance.* New York: McGraw-Hill Book Company, Inc., 1962.

Covers an extremely wide range of issues and sometimes reads like a personal journal. Parts 2, 3 and 4 deal with the question of tuition levels and student aid. Once an outspoken advocate of very much higher tuition fees, Harris here modifies his views and instead favors increases in scholarship aid, particularly increases in federal loan funds to be made available on a long term basis at subsidized rates of interest. Book includes four chapters comparing expenditures

of higher education, burden, capacity and effort in the 50 American states. The final section is devoted to the micro-economics of higher education, management of endowment costs, and economies in institutions and faculty salaries. The findings are summarized by the author in *Economic Aspects of Higher Education*, Edited by S. E. Harris, Paris: Organization for Economic Cooperation and Development, 1964, pp. 109-17. (Notes by M. Blaug from *An Annotated Bibliography of Benefits and Costs in the Public Sector* by James W. Becker, Research for Better Schools, Inc.)

Hoenack, Stephen A. *The American Economic Review*, Vol. LXI, No. 3, Part I June 1971, pp. 302-11.

In this paper students are grouped solely according to how they serve equity objectives of planners. Alternative hypothetical utility functions are specified in which the policymaker is neutral with respect to attendance from all groups, but which allow a trade-off between size of total enrollment and equity in the composition of the student body. The study requires that an objective function of planners be specified, that characteristics of students be related to the objective function, and that the policymaker be able to weight the relationships of different socio-economic student groups according to their contribution to the objective function. Then, based on demand functions for education by students in each group and an enrollment possibility function which takes account of the cost of educating students, as well as the revenue which can be expected at different enrollment levels, given the demand of each group, it is possible to determine differential fee structures and group enrollment levels which will maximize the planner's objective function.

Jencks, Christopher. "Giving Parents Money to Pay for Schooling," *The New Republic*, July 4, 1970, pp. 19-21.

In this article the author attempts to relieve fears that an educational voucher system (giving money directly to students or parents) could ever become operational. He describes several reservations which would be necessary to prevent either more racial and economic segregation than currently occurs.

Kidd, Charles V. *Developments in Federal Support of Graduate Education.* Proceedings of the Third Annual Council of Graduate Schools Summer Workshop for Graduate Deans, Brainerd, Minnesota, August 16-21, 1970.

This source documents the change in federal policies for support of graduate students which took place between 1968 and 1971. The author points out that rapid changes in any direction are painful and unsettling and that the problem before higher education today is to build a persuasive case for policy of moderate sustained growth and to persuade Congress and the Executive Branch to follow the policy. The author predicts that graduate education particularly will receive close scrutiny and be at the center of the debate as to what the nation has gained for the $1.1 billion spent for support of graduate students between 1965 and 1970 and the $1.5 billion spent in the decade of the 1960s.

Koerner, James D. "The Case of Marjorie Webster," *The Public Interest*, No. 20, Summer 1970, pp. 40-64.

This article discusses the first of two court decisions which resulted from attempts of Marjorie Webster College to be considered for accreditation in spite of its for-profit orientation. The first decision, which was rendered in favor of Marjorie Webster, found that the accrediting bodies involved were combinations within the meaning of the Sherman Anti-Trust Act and that the question of whether they had combined for commendable rather than evil purposes was not germane to the issue of whether anti-trust laws had been violated. The judge also found that evidence did not support the defendant's assumption that the profit motive was inconsistent with quality. The author calls for reform of regional accreditation practices, arguing that regional accrediting bodies are devoted more to the protection of their own membership than to the protection of students or the public good.

Mishan, Edward J. "Some Heretical Thoughts on University Reform," *Encounteer*, Vol. 32, March 1969, pp. 3-15.

The author proposes two major changes in the financing of higher education in Britain: (1) disclose the full costs of higher education and charge a tuition price which covers these costs; and (2) change from institutional grant to student loan financing of higher education. In the author's judgment these changes would free the universities from state bondage and give universities the incentive to economize since it would require competing for students. Also the change to a loan system is seen as removing the social anomaly whereby the community as a whole is made to finance its privileged student group.

Stubblebine, William Craig. "Institutional Elements in the Financing of Education," *Southern Economic Journal*, Vol. 32, No. 1, Part 2 Supplement, (James McKie, editor), July 1965, pp. 15-34.

An analytical investigation of alternative institutional frameworks for financing higher education. After experimenting hypothetically with various institutional mixes and types of financial arrangement, the author concludes that no single institutional setup can insure higher level support than any other. However, in terms of probability the analysis indicates that an institution which admits mixed private and public financing can generate more support than full private or full public financing.

U. S. Congress. Joint Economic Committee. *Economics and Financing of Higher Education in the United States*. A compendium of papers. Washington, D. C.: U. S. Government Printing Office, 1969.

A lengthy and extensive volume of papers concerning virtually all aspects of resource allocation in higher education.

Walsh, John. "Federal Graduate Aid: Down But Not Out," *Science*, Vol. 168, No. 3939, June 26, 1970, pp. 1559-61.

A review and digest of recent actions and pending changes in the support of graduate students by federal agencies. While the administration had announced a policy shift from direct grants to guaranteed loans, the current actions of federal agencies seem to indicate some mitigation in the announced policy.

White, Leon S. "Mathematical Programming Models for Determining Freshman Scholarship Offers." Sloan School of Management, Working Paper No. 379-69. Cambridge: Massachusetts Institute of Technology, March 1969. (Unpublished)

Application of mathematical optimization techniques to the problem of selecting candidates for scholarship assistance. The approach takes account of the likelihood that the student will succeed in the program of study and also the relationship between scholarship aid offered and the probability that the student will enroll.

1.4 Other

Arlt, Gustave O. "Graduate Education," *U. S. Encyclopedia of Educational Research*, 4th ed., pp. 544-51. New York: The Macmillan Company, 1969.

This source provides a general overview of the status of American graduate education, with reference to the history, organization, and national coordination of graduate education. Degree requirements, financial aid, research, and post-doctoral study are also reviewed.

Bowen, William G. *The Federal Government and Princeton University*. Princeton, New Jersey: Princeton University, January 1962.

The author documents the change in the nature of service outputs and organizational responses attributable to the influence of federal research clients. The author concludes that the instances in which government sponsors have been charged too little seem to outnumber the instances in which the government has been charged too much by a comfortable margin. Because the government is a monopoly buyer of research services, it can dictate conditions which do not reflect economic realities. An example given by the author is the use of teaching time released as a measure of opportunity costs of faculty working on research. Teaching time released understates the true opportunity cost of faculty because faculty members ordinarily do both teaching and independent research and the value of the independent research foregone is not included in the teaching time released measure. In general, the author points to the lack of agreement and lack of clarity which characterizes public and administrative concepts concerning the nature of institutions of higher education as one reason for inequities in the buyer-seller relationships between universities and the federal government.

Kidd, Charles V. "New Government-University Relationships in Research," *Higher Education*, Vol. 16, April 1960, pp. 3-6, 18-19.

Kidd traces the federal government and university partnership in research, particularly since World War II, and the pertinent problems arising from this relationship. This has become important because about 95 per cent of all federal research funds to higher education (in 1960) go to universities. Kidd points out that the federal government buys research in order to answer various questions in which it is interested. While this policy serves the national

interest, it does impose certain disadvantages on universities in that it influences the direction of faculty participation in research, distorts the research functions, and makes it difficult to maintain a balance between teaching and research. One problem, according to the author, is that federal funds are largely allocated to actions of scientific advisory groups which cannot take into account the full consequences of their decisions upon the institutions involved.

National Center for Educational Statistics. *The Academic and Financial Status of Graduate Students, Spring 1965*. Washington, D. C.: Office of Education, 1967.

This report gives the results of a survey of a nation-wide sample of students enrolled for advanced degrees in the spring of 1965. First professional degree students are excluded. Of the 20,140 questionnaires mailed out, a total of 15,710, or 78 per cent of the sample, were returned. The sample represented about 3 per cent of the students enrolled for graduate degrees in the spring of 1965. Reports on family income, grade points, employment experience, academic and living expenses, sources of funds, and factors causing delay in earning a doctorate are included.

Weaver, John C. *Some Dilemmas in Graduate Education*. A Report to The Carnegie Corporation of New York on a Travelling Fellowship, 1957-58. Lincoln: University of Nebraska, n.d.

Discussion on a general and more or less philosophical level of problems confronted by graduate education by an experienced educator.

2. OUTPUTS AND BENEFITS OF HIGHER EDUCATION

Sources included in this section deal both generally and specifically with the outputs and benefits of higher education. The authors found that this literature could be grouped under two sub-headings. The first sub-heading, Conceptual Literature, contains sources which discuss on a general philosophical or theoretical level the outputs and benefits of higher education. Since the reasoning involved in discussing benefits of graduate and undergraduate education is very much the same, no attempt has been made to separate sources on these lines. The second sub-heading, Measurement of Outputs and Benefits of Graduate Education, contains sources which address themselves solely to this task with respect to graduate education. However, since measurement techniques are not unique to studies of graduate education, some non-graduate education sources are also included.

2.1 Conceptual Literature

Becker, Gary S. "Education and the Distribution of Earnings," *American Economic Review*, Vol. 56, May 1966, pp. 358-70.

The sketch of a theory of personal income distribution based on the effects of education and training received by individuals, together with some empirical results explaining regional income differentials in the United States by variations in the amount of schooling. (Notes by M. Blaug from *An Annotated Bibliography of Benefits and Costs in the Public Sector* by James W. Becker, Research for Better Schools, Inc.)

_____, and Chiswick, Barry R. "The Economics of Education: Education and the Distribution of Earnings," *American Economic Review*, Vol. 56, May 1966, pp. 358-400.

Contents--Education and the distribution of earnings by Gary S. Becker and Barry R. Chiswick. Investment in the education of the poor: a pessimistic report by Eugene Smolensky. Measurement of the quality of schooling by Finis Welch. Discussion by Alice M. Rivlin, Lee R. Martin and Andre Danière. (Notes from *An Annotated Bibliography of Benefits and Costs in the Public Sector* by James W. Becker, Research for Better Schools, Inc.)

Bowles, Samuel. "Towards an Educational Production Function," *Education, Income, and Human Capital*. Edited by W. Lee Hansen. New York: National Bureau of Economic Research, 1970, pp. 11-61.

"Sam Bowles . . . has explicitly shown the gap between what estimators of education production functions have been doing (mostly least-squares regressions of achievement or even income on a host of explanatory variables), and what they could be doing with the econometric tools now available. The paper hints at the desirability of a system of simultaneous relations over a uniequational model, cleverly manipulates and combines variables to lessen the difficulties associated with collinearity, mentions that production functions should recognize that 'schools are multiproduct firms,' makes a start at giving some theoretical content to education production functions, produces some impressive estimates, and, in general, shows the way toward more respectable econometric analysis in this field that has been characterized by shabby statistics." (Comment by John E. Brandl, Office of the Secretary, Department of Health, Education, and Welfare in W. Lee Hansen, ed. *Education, Income and Human Capital*, page 61.)

Bowman, Mary Jean. *The Shaping of Economies and Men*. Paper given at the Conference on Education and Economic Development, Comparative Education Center, University of Chicago, April 4-6, 1963. New York: Committee on Economic Growth, Social Science Research Council, 1963.

This widely ranging interdisciplinary study offers an extensive review of the relation between education and economic development based on the work of many authors, and offers some challenging ideas on the subject. The adoption of the various well-known development strategies for educational planning in order to ensure its maximum utility is also discussed. (Notes from *An Annotated Bibliography of Benefits and Costs in the Public Sector* by James W. Becker, Research for Better Schools, Inc.)

Clark, H. F. *Cost and Quality in Public Education: The Economics and Politics of Public Education*, No. 5. Syracuse, New York: Syracuse University Press, 1963.

An outstanding popular discussion of the problem of "efficiency" in education, stressing the almost total failure to investigate the possibilities of improving and increasing the "output" of schools. A review of the literature on the returns to education (pp. 15-25) cites most of the lesser-known interwar items. A great deal of research in the effectiveness of different types of teaching is reviewed and the results of such research are shown to be suspect owing to a failure to allow for "experimental enthusiasm." (Notes by M. Blaug from *An Annotated Bibliography of Benefits and Costs in the Public Sector* by James W. Becker, Research for Better Schools, Inc.)

Fuchs, Victor R., ed. *Production and Productivity in the Service Industries.* New York: National Bureau of Economic Research, 1969.

Seven articles concerning conceptual and empirical aspects of measuring output and productivity in service industries (including education) with an introduction and summary by the editor.

Hartman, Lawton M., and The National Science Board. *Graduate Education: Parameters for Public Policy.* Washington, D. C.: U. S. Government Printing Office, 1969.

A thorough compilation of general trends in graduate education including institutional, student-related and other data. The author also discusses measurement of quality and concludes that the more efficient approach in terms of producing quality graduate programs is to upgrade those institutions higher up the quality scale first, since the marginal cost of doing so is much lower than for those at the lower end of the quality scale.

Hirsch, Werner A. "Program Budgeting for Education." MR-63. Paper presented at the 29th National Meeting of the Operations Research Society of America, Santa Monica, California, May 19, 1966. Baltimore, Maryland: Operations Research Society of America, 1966. (Unpublished)

A discussion of the need to orient university information systems towards outputs, rather than input classifications or sources of funds. Schematic design of an overall program budget for education is presented, along with a sample budget for national-level planning purposes.

Hughes, R. M. "A Possible Basis for Judging the Efficiency of a College Administration," *Proceedings of the Ohio College Association,* April 10-11, 1914.

A very early article in which use of unit cost for measuring educational value is proposed.

Lawrence, Ben; Weathersby, George; and Patterson, Virginia W., eds. *Outputs of Higher Education: Their Identification, Measurement, and Evaluation.* Boulder, Colorado: Western Interstate Commission for Higher Education, July 1970.

Ten papers by economists, educators and public officials concerning the identification and evaluation of instructional outputs of higher education. The papers are the result of a seminar held in Washington, D. C. May 3-5, 1970, conducted by the Western Interstate Commission for Higher Education, American Council on Education, and Center for Research and Development in Higher Education at Berkeley.

Machlup, Fritz. *Production and Distribution of Knowledge in the United States.* Princeton, New Jersey: Princeton University Press, 1962.

Chapter 4 presents a detailed review of all of the relevant literature on the costs of formal education in the U.S.A., together with some discussion of the rate of return approach at evaluating education. Elsewhere in this book, Machlup attempts for the first time to measure the total costs of all types of informal education. in the U.S.A. (Notes by M. Blaug from *An Annotated Bibliography of Benefits and Costs in the Public Sector* by James W. Becker, Research for Better Schools, Inc.)

Vandermeulen, Alice John. "Guideposts for Measuring the Efficiency of Governmental Expenditures," *Public Administration Review*, Vol. X, Winter 1950, pp. 7-12.

A brief article illustrative of the post-war concepts of public administration. Orientation of decisions and budgeting toward outputs and the value of services generated is urged.

Wilkinson, Bruce W. *Studies in the Economics of Education*. Occasional Paper No. 4. Ottawa, Canada: Economics and Research Branch, Department of Labour, 1965.

A summary and assessment of the literature which investigates the relationship between education and economic growth. Education is discussed as investment in human capital. Differences between human capital and physical capital which set education off from other investment problems are discussed, along with various measurement techniques.

Wiseman, Jack. "Cost Benefit Analysis in Education," *The Southern Economic Journal*, Vol. 32, No. 1, Part 2, July 1965, Supplement *Education and the Southern Economy*, Edited by James W. McKie, pp. 1-12.

A discussion of conceptual problems involved in measuring the benefits of education. The article is fairly unique in asserting that the consumption component in benefits of educational outputs is probably cancelled out by the fact that the purpose of education is to change preferences.

2.2 Measurement of Outputs and Benefits of Graduate Education

Ashenfelters, O., and Mooney, Joseph D. "Some Evidence on the Private Returns to Graduate Education," *Southern Economic Journal*, Vol. 60, January 1969, pp. 247-56.

After summarizing existing research on returns to graduate education, the authors attempt to refine the analysis in order to compare returns to various program lengths in different disciplines. Using Woodrow Wilson fellowship data and extrapolating data on earnings profiles from the Hanoch Study,* the authors estimated shift effects of various non-academic parameters, as well as differentials by academic field and computed average incomes for different degree and school combinations. They found the three-year Ph.D. to be the best investment with productivity trailing off to zero at the margin for five-year programs. Social Science Ph.D.'s and non-academic employment had the highest differential returns, while academically employed Humanities Ph.D.'s had the lowest. Results were sensitive to the discount rate.

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*See Hanoch, Giora. "Personal Earnings and Investment in Schooling," *Journal of Human Resources*, Summer 1967, pp. 310-29.

Berls, Robert H. "Higher Education Opportunity and Achievement in the United States," *Economics and Financing of Higher Education in the United States*. (U. S. Congress, Joint Economic Committee), pp. 145-204. Washington, D. C.: U. S. Government Printing Office, 1969.

The author investigates the probability of students with Bachelor's Degrees entering graduate school and tests the hypothesis that this probability is correlated with ability and socio-economic status. Article concludes that ability is somewhat more important than socio-economic status in determining who will enter graduate school.

Brown, David G. "A Scheme for Measuring the Output of Higher Education," *The Outputs of Higher Education: Their Identification, Measurement and Evaluation*, pp. 27-38. Boulder, Colorado: Western Interstate Commission for Higher Education, July 1970.

The author discusses output measurement for higher education on a general level, lists six criteria for operationality of measurements, and then discusses several types of measures. While the paper contains no statistical estimates by the breakdowns given, it does represent a suggested approach for beginning output measurement.

Butter, Irene H. *Economics of Graduate Education: An Exploratory Study*. Washington, D. C.: U. S. Department of Health, Education, and Welfare, Office of Education, Bureau of Research, November 1966.

The study attempts to derive social rates of return to investments in education. However, since the non-existence of any external benefits is assumed, the study might be termed a pre-tax private rate of return study. In this context, explicit objectives are to present estimates of the total cost and of component cost of graduate training in four disciplines for twelve universities and to analyze the cost calculations to determine some of the factors responsible for variations of the average cost per Ph.D. within and between disciplines.

Campbell, Robert, and Siegel, Barry N. *The Demand for Higher Education in the United States, 1919-64*. Eugene: The Center for the Advanced Study of Educational Administration, University of Oregon, July 1966.

The authors derive an aggregate demand schedule for enrollments in terms of income and price. The authors found that the ratio of enrollments to eligible students (where eligible students means those students in the 18-24 year age group with high school diplomas not in the Armed Services) remained fairly constant from 1919 to 1964. What variations did occur provide the authors with an opportunity to test the hypothetical relationship between demand, income and price. Opportunity costs are explicitly excluded from price because of the fact that part-time jobs which college students use to support themselves are often the very same which they are supposedly foregoing. Hence, an increase in such opportunity cost may well work to increase as well as to decrease demand. The authors use a Cobb-Douglas functional form to test their hypothesis.

Cartter, Allan M. *An Assessment of Quality in Graduate Education.* Washington, D. C.: American Council on Education, 1966.

For each major discipline in which graduate degrees are offered in American universities, this study ranks universities on the basis of certain objective measures and subjective ratings which were achieved by means of questionnaires. Objectives of the study were to bring earlier qualitative studies of graduate education up to date, to widen the assessment to include all major universities in the United States, and to test the value of subjective assessment. One hundred and six institutions were examined in thirty major academic disciplines.

Cartter, Allan M. "Qualitative Aspects of Southern Higher Education." Conference on Education and Human Resources, October 9-10, 1964. Washington, D. C.: The Inter-University Committee for Economic Research on the South, 1964. (Unpublished)

This paper lists qualitative aspects of university outputs. The ratings are on the basis of publications, number of national fellows (that is, national scholarship students at the universities), opinion of other faculty, number of degrees awarded, percentage of faculty holding a doctorate, baccalaureates who later earned doctorate, educational revenue per student.

Cartter, Allan M., and Farrell, Robert L. "Academic Labor Market Projections and the Draft," *Economics and Financing of Higher Education in the United States.* (U. S. Congress, Joint Economic Committee), pp. 359-74. Washington, D. C.: U. S. Government Printing Office, 1969.

Assesses the effect of changes in selective service regulations in February 1968 on the supply of teachers and researchers produced by graduate education. On the basis of information available to them, the authors do not anticipate a serious curtailment of scientific research because of manpower shortages falling below the levels already dictated by more stringent budgetary measures, nor do they believe that the draft will result in critical shortages of college and university faculty in the early 1970s.

Dodge, David A., and Stager, David A. A. "Returns to Graduate Study in Science, Engineering, and Business," Working Paper No. 7014. Toronto, Canada: Institute for the Quantitative Analysis of Social and Economic Policy, University of Toronto, October 1970. (Unpublished)

Before and after tax earnings differentials are used to calculate social and private rates of return to investment in Science, Engineering and Business. The paper includes a discussion of possible sources of bias in the measurement of components of both costs and benefits.

Galper, Harvey, and Dunn, Robert M., Jr. "A Short-Run Demand Function for Higher Education in the United States," *Journal of Political Economy,* Vol. 77, No. 5, September-October 1969, pp. 765-77.

The authors estimate a demand function for undergraduate education. The influence of the military is reflected in two ways: (1) subsidies to servicemen through the G.I. Bill; and (2) the draft,

which tends to lower the opportunity cost of college education. The authors hypothesize on the basis of high costs and uncertainty involved in information that elasticity of demand with respect to the interest rate and with respect to income differentials is low. On the other hand, price elasticity they expect to be high because both income foregone and direct tuition and other costs are known in advance. Elasticity of enrollment with respect to four variables is estimated: high school graduates, .9403; personal income, .06917; growth of the Army, -.2568; discharges from the army, .1282.

Hall, Wayne C. "Predoctoral Education in the United States: Current Parameters and the Data Base." Washington, D. C., n.d. (Unpublished)

A summary and review of enrollment trends from 1960 to 1967 and projections from 1968 through 1980. The author predicts total graduate enrollment by 1980 of between 1.3 and 1.5 million students.

Hanoch, Giora. "Personal Earnings and Investment in Schooling," *Journal of Human Resources*, Summer 1967, pp. 310-29.

Along with Irene Butter, one of the first attempts to estimate returns to graduate education. Like Butter, Hanoch uses the discounted earnings differential approach to measure benefits.

Hopkins, David S. P. *An Analysis of University Year-Round Operation.* Report No. 2, Administrative Studies Project in Higher Education. Berkeley: University of California, December 1969.

Results of an investigation of the benefits of university year-round operation as opposed to three-quarter year operation. Main results briefly are: (1) year-round operation will result in approximately a 5 per cent increase in annual graduation rates; and (2) if a greater proportion of students will be willing to attend the university on a year-round basis than do currently, the graduation rate will increase linearally from a value of 6.2 per cent of the enrollment ceiling to 8.3 per cent of the ceiling.

Houthakker, H. S. "Education and Income," *Review of Economics and Statistics*, Vol. 51, February 1969, pp. 24-8.

A sophisticated attempt to measure the present value of lifetime income from various years of schooling, using 1950 Census data and concluding with some widely quoted qualifications about this approach to the economic benefits of education. (Notes by M. Blaug from *An Annotated Bibliography of Benefits and Costs in the Public Sector* by James W. Becker, Research for Better Schools, Inc.)

Hunt, Shane J. "Income Determinants for College Graduates and the Return to Educational Investment," *Yale Economic Essays*, Vol. 3, No. 2, 1963, pp. 305-57.

An attempt by means of multiple regression analysis to improve estimates of the income-benefits of college education in the U.S.A. by studying the effect of an improved quality of undergraduate education on the yield of investment in graduate education. (Notes by M. Blaug from *An Annotated Bibliography of Benefits and Costs in The Public Sector* by James W. Becker, Research for Better Schools, Inc.)

Illinois Institute of Technology Research Institute. *TRACES (Technology in Retrospect and Critical Events in Science)*, Vol. 1. Chicago, December 14, 1968.

_____. *TRACES*, Vol. 2. Chicago, January 30, 1969.

These studies trace the development of conceptual and technological discoveries as represented by various research reports and journal articles in order to identify their contributions to major scientific breakthroughs. Development of the birth control pill, for example, is shown to be the culmination of a stream of research results occurring throughout the 20th Century.

Knorr, Klaus. "On the Cost-Effectiveness Approach to Military Research and Development," *Bulletin of the Atomic Scientists*, Vol. 2, November 1966, pp. 11-14.

A discussion of the value and limitations of cost benefit analysis. The author cautions that policymakers must be aware of all costs and all benefits if cost benefit analysis is to be relied on as a decision making tool.

Master Plan Study Committee J. *Research and Graduate Education*. Salt Lake City: Utah Coordinating Council of Higher Education, January 1968.

A study of the relationship between support of doctoral programs and regional industrial growth, with reference to specific cases. The study attempts to justify subsidies to doctoral programs on the basis of returns that are essentially private and there is no analysis of transfers or distortions at the margin.

Menning, Walter Richard. "The Measurement of Educational Output: An Investigation of the Value Added Concept." Unpublished Master's Thesis. Cambridge: Alfred P. Sloan School of Management, Massachusetts Institute of Technology, July 3, 1970. (Unpublished)

An attempt to measure "value added" in a sample of 40 graduates of the Bachelor of Science program in Mathematics at MIT, using results of Graduate Record Examinations, advanced mathematics tests, and similar results from College Entrance Examination Board mathematics achievement tests taken prior to admissions. A regression analysis reveals a slight positive relationship between test score differentials and the number of mathematics credit units earned. Attempts to separate the effect due to initial achievement levels of entering students and to subsequent credit hours earned at MIT did not yield significant results. Unit costs associated with the value added in terms of test score differentials are also measured. The author concludes that this technique is not a promising one because of lack of precision in testing and the difficulty in holding student ability levels constant.

Mooney, Joseph D. "Attrition Among Ph.D. Candidates: An Analysis of a Cohort of Recent Woodrow Wilson Fellows," *The Journal of Human Resources*, Vol. III, No. 1, Winter 1968, pp. 47-62.

Systematic isolation of the quantitative importance of the number of explanatory variables for the problem of attrition of doctoral candidates. Sex, field of study, size of graduate school,

and academic achievement all seem to have significant impact on success rates of graduate students in the sample. Socio-economic status of parents and parental educational background did not appear to influence success rates. The sample consisted of approximately 3,500 Woodrow Wilson national fellowship holders during 1958-60. Success rates were measured by taking percentage of students who had achieved the Ph.D. by mid-1966.

O'Neill, June. *Resource Use in Higher Education: Trends in Output and Inputs of American Colleges and Universities, 1930-67*. Berkeley, California: The Carnegie Commission on Higher Education, 1971.

A five-chapter investigation of trends in productivity in higher education. Using cost differentials as a measure of quality change and deflating current dollar values to constant dollar terms, the author finds that there has been roughly no change in productivity in higher education for 30 years. The last chapter of the draft offers alternative explanations for this apparent lag in productivity in higher education.

Pugliaresi, Lucian S. *Inquiries into a New Degree: The Candidate in Philosophy*. Paper P-13, Ford Foundation Research Program in University Administration. Berkeley: Office of the Vice President--Planning and Analysis, University of California, November 1970.

Pugliaresi discusses the pros and cons of formally recognizing the achievement of candidacy status by awarding a Candidate in Philosophy Degree. The purpose of the study is to explore both the institutional economic impact of the new degree and to determine whether the University of California at Berkeley created a net benefit by what appeared to be a costless operation, i.e., certifying candidacy status. The author concludes that although marginal costs of the degree were zero in terms of expenditures, there were costs to the public and students that outweigh benefits the degree might bring. The author also concludes that the degree does not seem to fulfill requirements for employment in the community college faculty market.

Roose, Kenneth D., and Andersen, Charles J. *A Rating of Graduate Programs*. Washington, D. C.: American Council on Education, 1970.

Updates the findings of the 1966 study by Dr. Allan Cartter, *An Assessment of Quality in Graduate Education*.

Schaafsma, J. "The Demand for Higher Education in Canada." Working Paper Series No. 6903. Toronto, Ontario, Canada: Institute for the Quantitative Analysis of Social and Economic Policy, University of Toronto, September 1968. (Unpublished)

Demand is defined as the probability that a member of the 18-24 age group will attend a university. Multiple regression analysis is used to estimate the effect of increased educational costs, study time, productivity of educational capital, supply of funds (i.e., the interest rate), and degree of subsidization on demand.

Stager, David. "Monetary Returns to Post-Secondary Education in Ontario, 1960-64." A paper presented to the Société Canadienne de Science Economique, 9 October 1968, at the University of Ottawa. Toronto, Ontario, Canada: Department of Political Economy, University of Toronto, n.d. (Unpublished)

Estimates of social and private (pre- and post-tax) present values, benefit cost ratios, and internal rates of return, for investment in education by sex and type of degree, post-secondary education in Ontario. The framework used is that described by Becker in *Human Capital*, New York, National Bureau of Economic Research, 1964. This study includes only direct monetary benefits. However, the study is unique among graduate education rate of return studies in that results are presented for alternative assumptions about the percentage of earnings differentials which can be attributed to education.

_____. "Some Economic Aspects of Alternative Systems of Post-Secondary Education." A paper presented at the Seventh Canadian Conference on Educational Research, Victoria, B. C., January 28, 1969. Toronto, Ontario, Canada: Department of Political Economy, University of Toronto, n.d. (Unpublished)

The author tests two major hypothetical alternatives to the current system of higher education in Ontario. One alternative is to replace all four-year colleges with community colleges throughout Ontario; another is to have all existing institutions run on a year-round basis. The author concludes that the first proposal would result in negligible improvement, while modest improvement in the rate of return would be produced by the second proposal.

Swift, William J., and Weisbrod, Burton A. "On the Monetary Value of Education's Inter-Generation Effects," *Journal of Political Economy*, Vol. 73, December 1965, pp. 643-9.

Presents an empirical model for placing a monetary value on the influence of education in one generation upon attitudes and educational attainments in the next generation. Rates of return are estimated from two viewpoints, the actual money expenditures alone, and the actual expenditures on education per student plus earnings foregone. (Notes from *An Annotated Bibliography of Benefits and Costs in the Public Sector* by James W. Becker, Research for Better Schools, Inc.)

Welch, F. "Measurement of the Quality of Schooling." Investment in Human Capital Series, Paper No. 65:12. Chicago, Illinois: University of Chicago, December 4, 1965 (Unpublished)

While not a study of higher education, the techniques used are applicable. Using a sample of rural farm males, 25 years or older that earned income in 1955, the author estimates earnings differentials due to years of primary and secondary education. According to the author the evidence is strong that the most important determinants of quality difference are teacher quality, as reflected in salaries and size of secondary schools. Apparently, real economies can be obtained from the consolidation of school districts and specialization of teachers. Also, wide variance in the

observed income estimates suggest that mobility is limited and that differential marginal returns to education should be calculated separately by region. Regional and race dummy variables are included in the regression. Among the author's conclusions are that income differentials are positively correlated with quality (where quality is measured by teacher/student ratios) and negatively correlated with size of school (where teacher/student ratios are held constant).

Wright, Charles R. "Success or Failure in Earning Graduate Degrees," *Sociology of Education*, Vol. 38, Fall 1964, pp. 73-97.

Wright traces the progress of 176 graduate students for 11 years. Of 115 Master's Candidates enrolling in 1950, 46 received no degree, 58 earned the hoped-for Master's Degree, and 11 completed a Doctorate by 1961. Of 61 Ph.D. aspirants studied, 20 successfully completed the Doctorate within 11 years, 8 terminated their studies with a Master's, and 33 failed to earn any further degree, although 19 of the 33 already had Master's degrees at the time of enrollment. Wright found standard measures of intellectual endowment were not significantly tied to the probability of success, but a positive relationship between the student's social adjustment and success was reported. Candidate's age was inversely correlated with success.

3. INPUTS AND COSTS--GENERAL

This section includes sources helpful for obtaining a general understanding of concepts of cost in general and with particular reference to institutions of higher education. The first sub-heading, Conceptual Literature, contains sources which discuss costs on a general and theoretical level. The second sub-heading, Cost Structure Models, consists of sources which describe, in a more or less formal manner and using models of varying degrees of sophistication, the structure of costs at institutions of higher education.

3.1 Conceptual Literature

Cavanaugh, Alfred D. *A Preliminary Evaluation of Cost Studies in Higher Education*. Berkeley: Office of Institutional Research, University of California, October 1969.

A thorough review of institutional cost studies from 1935 through the late 1960s. Close attention is paid to the nature of cost studies, their purposes and apparent uses. Among the author's conclusions is that, while cost studies may have been initiated for purposes of internal control over expenditures, their chief use has apparently been for justifying additional expenditures by the state. In general, the author finds techniques for studying and controlling internal expenditures are no further advanced than they were in 1935.

Darlington, P. E. *An Analysis of the Obstacles Perceived by Graduate Students as Delaying Their Progress Toward the Doctorate*. Ann Arbor, Michigan: University Microfilms, 1970.

"This study is concerned with the duration of doctoral study--presently eight years on the average from baccalaureate to doctorate--and the factors responsible for delaying the completion of the doctorate. Information on delaying factors or obstacles was obtained from a national sample of 3,380 graduate students at all stages of Ph.D. preparation. The students, drawn from 23 fields of study and 63 institutions, responded to an Office of Education questionnaire distributed in the spring of 1965. . . .The following classes of obstacles were reported by the percentages of the sample indicated: financial, 30.0%; academic requirements, 10.1%; institutional personnel, 5.1%; personal, 13.8%; other (external to the student and graduate school), 12.9%; stated no obstacle had delayed progress, 9.6%; not ascertained, 29.6%." (Abstract by the author.)

Evans, John M., and Hicks, John W. *An Approach to Higher Education Cost Analysis*. Studies in Higher Education, No. 91. Lafayette, Indiana: Purdue University, Division of Educational Reference, 1961.

This paper might be considered an early attempt to institute program budgeting in institutions of higher education. Institutional accounts are described in terms of major programs in an attempt to isolate and allocate full costs of producing instructional outputs.

Foley, Eugene P., Jr. "Reducing Indirect Costs--A Case Study," *National Association of Accountants Bulletin*, Vol. 46, June 1965, pp. 19-24.

A discussion of the problems faced by industry in allocating indirect costs. This article demonstrates that these problems are by no means unique to higher education management. The author recommends close scrutiny of the production process in order to determine use of support services in the production of various outputs.

Hicks, John W. "Making the Best of Limited Resources," *College and University Business*, Vol. XXIII, December 1967, pp. 21-3.

A relatively early article by the co-author along with John M. Evans of the "Progressive Primary Use Plan for Allocating Indirect Costs." In this article,Hicks discusses the problem of achieving optimal resource allocations in higher education and suggests as a useful conceptualization of the outputs of higher education the production of an "environment for learning." The article distinguishes between two types of institutional research; one which is largely descriptive of current input and output levels and relationships, and another which is used for purposes of evaluating and comparing the current situation with feasible alternatives.

Hull, L. E. "Pitfalls in the Use of Unit-Cost Studies," *Journal of Higher Education*, Vol. XXXII, October 1961, pp. 371-86.

Lists the reasons why unit costs are not a valid measure of output.

Judy, Richard W. "Costs: Theoretical and Methodological Issues," *Cost-Benefit Analysis of Manpower Policies*, pp. 16-29. Edited by G. G. Sommers and W. D. Woods. Kingston: Industrial Relations Centre, Queen's University, 1969.

This document discusses economic concepts of cost and problems which arise in making these concepts operational. Some of the specific problems referred to are: (1) use of prices as measures of foregone benefits, i.e., opportunity costs; (2) the problem of costing joint products; (3) the problem of external costs; (4) the difference between incremental average and total costs; (5) constraints and shadow prices; and (6) uncertainty and irreversible decisions.

Kempster, John H. "Marginal Cost and Income Accounting--Some Perennial Problems," *National Association of Accountants Bulletin*, Vol. 46, March 1965, pp. 21-31.

An example of distinctions made in industrial accounting literature between the concepts and use of average and marginal cost information.

Kettler, Raymond W. "What's Wrong With the Unit Cost Idea?" *College and University Business*, Vol. XIV, May 1953, p. 17.

An article similar to that found in industrial accounting literature of the same period which makes the distinction between concepts and uses of marginal and average cost information.

Kleerekoper, J. "The Economic Approach to Accounting," *The Journal of Accountancy*, March 1963, pp. 36-40.

Another example of the distinction made in industrial accounting literature between marginal and average costs.

McMullen, Kenneth E. "Effective Overhead Budgeting," *National Association of Accountants Bulletin*, Vol. 43, September 1961, pp. 49-62.

The article offers suggestions for improving budgetary allocations to organizational units which perform a support role. The author distinguishes between indirect costs which are controllable in the short run and those which are not, to point out the fact that some expenditures are less responsive to short-run management decisions than others. Internal accounting and pricing to support services is recommended by the author for purposes of control.

Quade, E. S. *Cost-Effectiveness: An Introduction and Overview*. No. P-3134. Santa Monica, California: The Rand Corporation, May 1965.

This source provides a general overview of benefit cost analysis and its uses in policy decisions.

Rand, Edson R. "If Unit Cost Calculations Are to be Valid," *College and University Business*, Vol. XIX, No. 2, August 1955, pp. 25-6.

A brief discussion of the true information content of unit costs.

Weathersby, George B. *Educational Planning and Decision Making: The Use of Decision and Control Analysis*. Paper P-6, Ford Foundation Research Projects in University Administration. Berkeley: Office of the Vice President--Planning and Analysis, University of California, May 1970.

A general discussion of the role of analysis in resource allocation and policy decisions in higher education. The state of the art of decision analysis techniques is also summarized. Decision-making models are classified by the author as: (1) resource prediction models; (2) student and faculty flow models; (3) financial management models; and (4) management information systems. Examples of each are given.

Williams, Robert L. "Instructional Cost Studies in Perspective," *College and University Business*, Vol. XXVI, March 1959, pp. 28-9.

Criticism of the widespread use of average cost information as a proxy for output quality and as a basis for support.

Winslow, Frederic D. *The Capital Costs of a University*. Paper P-9, Ford Foundation Research Program in University Administration. Berkeley: Office of the Vice President--Planning and Analysis, University of California, January 1971.

This paper contains definitions of capital and depreciation and provides a conceptual approach to the measurement of capital costs at institutions of higher education. Three procedures are recommended for evaluating capital; these are book value, depreciated replacement value, and present or market value. These techniques are then compared with reference to data related to the capital stock of the University of California at Irvine.

3.2 Cost Structure Models

Chase, John L. *Graduate Teaching Assistants in American Universities--A Review of Recent Trends and Recommendations*. No. OE-58039. Washington, D. C.: U. S. Office of Education, 1970.

A new study on the status and problems of teaching assistants with recommendations as of May 1970. There are tables relative to graduate assistant stipends; relationship between experience and employment hours per week worked for stipends. Also included is a statement of administrative costs of the T.A. system, training programs and a great deal relative to the use of Graduate Teaching Assistants in undergraduate education. (Notes from *An Annotated Bibliography of Benefits and Costs in the Public Sector* by James W. Becker, Research for Better Schools, Inc.)

Cope, Robert G. "Simulation Models Should Replace Formulas for State Budget Requests," *College and University Business*, March 1969, pp. 30-4.

The author argues that simple formulas tying finance of higher education to a single variable such as enrollments cannot begin to take account of the complex inter-relationships of activities within institutions of higher education. More complex models which take account of these interactions are seen as promising tools for predicting resource requirements.

Firmin, Peter A.; Goodman, Seymour S.; Hendricks, Thomas E.; and Linn, James J. *University Cost Structure and Behavior*, NSF-C451. New Orleans, Louisiana: Tulane University, August 31, 1967.

The authors develop a model that identifies, measures and analyzes the variables which affect the costs of institutional functions. The cost structure of the university is analyzed as a system in which the various factors affecting costs are interrelated in order to develop a methodology for determining the costs associated with given goals or the goals feasible under varying conditions of cost. In particular, the authors used simulation techniques to measure the impact of alternative decisions and changes in input levels. The findings of these investigations are preceded with a thorough discussion of conceptual and methodological aspects of university costs.

Gibson, Thomas Taylor. "Unit Costs of Higher Education: A Study of the University of Colorado." Unpublished Ph.D. Dissertation. Boulder: University of Colorado, 1968.

The study includes a brief history of costing procedures in higher education and derives full costs per student credit hour by level of course and discipline grouping for the academic year 1966-67 using University of Colorado data. The "Simplistic" procedure (see Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*) is used to determine full costs. The author then uses various mathematical cost functions to test the relationships between costs and enrollments. The author also investigates cost differential for in-state and out-of-state students and compares these with tuition differentials.

Goddard, Haynes C. *A Study in the Theory and Management of Benefits and Costs in the Public Library*. Cincinnati, Ohio: Department of Economics, University of Cincinnati, 1970.

While this study is aimed at public libraries, it is included in this bibliography because it provides an econometric analysis of production and cost relationships in libraries and reveals increasing returns to scale for book circulation in the output measure chosen for analysis. The type of analysis used would be valuable in institutions of higher education for determining the distribution of benefits and consequently the allocation of costs.

Gulko, Warren W. "Program Classification Structure." Preliminary Edition for Review. Boulder, Colorado: Western Interstate Commission for Higher Education, June 1970, as revised March 1971. (Unpublished)

This document contains a very comprehensive description of activities in institutions of higher education and organizes them in a program budgeting framework using various levels of aggregation to group similar activities into sub-programs and programs.

_____. "Unit Costs of Instruction: A Methodological Approach." Boulder, Colorado: Planning and Management Systems Division, Western Interstate Commission for Higher Education, January 1971. (Unpublished)

This paper provides a preliminary basis for developing comparable unit cost information across institutions by expressing various types of unit cost in terms of common algebraic elements. A procedure for determining actual costs of degrees is outlined and is applied through an empirical study using artificial data.

Henle, R. J. *Systems for Measuring and Reporting the Resources and Activities of Colleges and Universities*. Washington, D. C.: National Science Foundation, 1967.

A study aimed at developing and standardizing definitions of outputs and inputs, as well as activities, within institutions of higher education. In addition to a descriptive and exhaustive review of inputs, outputs and activities, the study offers broad methodological and philosophical discussions of relationships between all of these factors and problems involved in quantifying these relationships on a non-technical level.

Koenig, H. E.; Keeney, M. G.; and Zemach, R. *A Systems Model for Management, Planning, and Resource Allocation in Institutions of Higher Education.* East Lansing: Division of Engineering Research, Michigan State University, September 1968.

One of the few simulation models for higher education planning currently available in operational form.

Peters, Max S. "Ratios and FActors for Teaching and Space Requirements for Quality Engineering Education." Audience Reference Notes for Presentation at the 78th Annual Meeting of American Society for Engineering Education, Columbus, Ohio, Event No. 65. Boulder, Colorado, June 23, 1970. (Unpublished)

This paper presents a discussion of proposed numerical values of ratios and factors relative to costs and needs for teaching and space to provide quality engineering education. A series of proposed ratios and factors are given based on values recommended by engineering deans in 1967, and an interpretation of the significance of the values is given. A proposal is made that a national engineering study on this subject be initiated and conducted by the Engineering College Administrative Council (ECAC) of ASEE to provide recommended ratios for engineering with the prestige and backing of a national organization. The key importance of selected and special ratios for engineering is emphasized along with the desirability of considering engineering budgets separately from the other components of the University as typifies the situation for a true professional school. (Abstract by Max S. Peters.)

Rowe, Stephen M.; Wagner, W. Gary; and Weathersby, George B *A Control Theory Solution to Optimal Faculty Staffing.* Paper P-11, Ford Foundation Research Program in University Administration. Berkeley: Office of the Vice President--Planning and Analysis, University of California, November 1970.

The authors apply optimizing techniques developed in the calculus of variations, a relatively sophisticated branch of mathematics, to the problem of optimal faculty staffing over time. On the assumption that budget allocations in one time period depend on the rate of utilization of resources in previous time periods and using parametric information, such as transition matrices, the authors generate a solution to the problem of determining optimum faculty staffing in each time period.

Terman, Frederick E. "Economic Factors Relating to Engineering Programs," *Journal of Engineering Education,* Vol. 59, No. 6, February 1969, pp. 510-14.

A discussion of trends in the supply of engineering education. The author finds that the supply of undergraduate engineering students available to the university is severely limited and is also little affected by the need for engineers, by the number of engineering schools in an area, by the salaries received by young engineers, or by exposure to engineering and industrial activities during the pre-college period. The author identifies a minimum

economic size with relation to degree output per year. Concerning graduate instruction, the author states that formal classroom instruction does not represent an important cost factor for Ph.D.'s provided a comprehensive M.S. program of adequate size exists. Therefore, graduate work, including Ph.D. work, need not be unduly expensive provided there are enough graduate students to populate adequately the organized courses at the graduate level and provided there are adequate extramural funds to support the research programs.

University of California. *California and Western Conference Cost and Statistical Study*. For the year 1954-55. Berkeley: University of California Printing Department, n.d.

A comprehensive study of the conceptual and empirical aspects of providing an environment for learning in institutions of higher education. The basic approach of the study is to analyze factors which make up the environment for learning. Instructor time and salaries were allocated among fifteen functions and activities. Other teaching expenditures, such as secretarial, clerical and technicians' wages, classrooms, teaching laboratories, and supplies were allocated to lower-division undergraduate, upper-division undergraduate, and graduate levels. From these compilations cost figures were developed by instructional levels for each department and also for each subject defined according to the standard classification. Also compiled were class size, teaching load and salary level data. Instructional expenditures were analyzed in order to examine the variations in the expenditures among institutions, levels, and fields and to determine the effect of various factors on these expenditures. Chapters on departmental research, total operating expenditures, and physical plant operation and maintenance discuss the magnitude of expenditures in these areas but do not relate them specifically to instructional output. The study concludes by recommending use of the production function approach in order to relate costs in these other areas to the environment for learning and specific credit hour production, for purposes of planning and decision making.

University of Kentucky. "A Model for Cost Analysis in Higher Education: A Proposal to Develop a Mathematical Model at the University of Kentucky on the Basis of Preliminary Work." Lexington, 1969. (Unpublished)

A proposal, since withdrawn, to develop a mathematical costing model at the University of Kentucky. The report suggests an indirect cost allocation procedure similar to that described as "Recursive" in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*. Total salary costs are suggested as a basis for allocating the costs of institutional support activities with these exceptions: College and Departmental Administration costs are allocated on the basis of full-time equivalent academic personnel for undergraduate colleges and on the basis of full-time equivalent student for the graduate school; Physical Plant

and Maintenance costs are allocated on the basis of square feet of space; Student Services costs are allocated on a per-capita basis with the exception of Student Support costs which are allocated on the basis of full-time equivalent students; Libraries are allocated in the following proportions--50 per cent to Instructional Activities, 10 per cent to Public Service, and 40 per cent to Organized Research activities. Use of three different types of output measure is recommended: (1) thesis; (2) full-time equivalent students (in order to measure output of thesis and dissertation research activities); and (3) student credit hour by three levels (to indicate output of instructional activities).

Weathersby, George B. *The Development and Applications of a University Cost Simulation Model.* Berkeley: Graduate School of Business Administration and Office of Analytical Studies, University of California, 1967.

Using a number of simple linear approximations of activity relationships within universities, this report develops a simulation model of the Berkeley and UCLA campuses of the University of California. Actual formulation testing and implementation of the model are discussed first, then the value of the model is demonstrated in several decision situations. Finally, the report suggests several possible avenues for future research in this field.

_____, and Weinstein, Milton C. *A Structural Comparison of Analytical Models for University Planning.* Paper P-12, Ford Foundation Research Program in University Administration. Berkeley: Office of the Vice President--Planning and Analysis, University of California, August 1970.

A thorough comparison of analytical models currently available for assisting decision making in higher education. Models are distinguished by function, and by internal characteristics. Three functions are distinguished: (1) to derive measures of characteristics of a system; (2) to project expenditures or costs; and (3) to allocate resources among various uses. While the first two are largely descriptive, the latter is an explicit decision-making tool which is used to select optimal points from among points in a feasible set of alternatives. Models appropriate for each purpose, descriptive, predictive, and optimizing, are described and experience in use of those which are currently operational is discussed.

4. INPUTS AND COSTS--MEASUREMENT

This section includes all cost studies reviewed by the authors during the course of the GRADCOST project. For the most part these are studies done at and by institutions of higher education, state councils, or coordinating boards. The first sub-heading, Direct Cost Studies, consists of both faculty salary studies and instructional cost studies. The latter type of study contains, in addition to faculty salary costs, the staff salary costs as well as direct supply and administrative overhead expenses at the departmental level. The second sub-heading, Full Cost Studies, contains allocated portions of institutional support costs, as well as the direct departmental costs. Virtually all full cost studies are based on current operating expenditures; few, if any, contain allocations from capital budgets.

4.1 Direct Cost Studies

Alden, John W. *The Utilization of University Resources by Graduate Students.* Champaign: University Office of Administrative Data Processing, University of Illinois, 1970.

> The preface of this proposal reads as follows:
> "A random sample of about 150 graduate students will be selected from each of ten discipline groupings at a major midwestern public university with a population of 8000 graduate students. From this sample, equal numbered groups of students will be randomly assigned to the weeks of First Semester Fall, 1970-71. Utilizing this rolling sample, data about the utilization patterns of graduate students over time will be obtained. . . . Analysis of variance techniques will be employed to determine the significance of the differences in resource utilization between the various discipline groupings."

In particular, the author intends to determine the relationship of costs in various "resource centers" and the following independent variables: (1) college and curriculum codes; (2) type of financial aid; (3) date and year of entry; (4) sex; (5) marital status; (6) number of semesters in degree program; (7) status of graduate college; and (8) level of classification.

Bareither, H. D., and Schillinger, J. L. *University Space Planning--Translating the Educational Program of a University and the Physical Facilities Requirements*. Urbana: University of Illinois Press, 1968.

Information on the relationship between graduate student research and physical facilities required to support it.

Bisbey, Gerald D. *Instructional Costs at the University of Northern Iowa 1968-69*. Research Report No. 127. Cedar Falls: Bureau of Research and Examination Services, University of Northern Iowa, March 16, 1970.

Costs, both per FTE student and per student credit hour by student level, are presented for the fiscal year 1968-69. Costs are presented both by discipline groupings and within discipline groupings for various departments, which, however, are not identified by name. Results are presented for four campuses.

Breneman, David W. *The Stability of Faculty Input Coefficients in Linear Workload Models of the University of California*. Research Report No. 69-4, Ford Foundation Research Projects in University Administration. Berkeley: Office of the Vice President--Planning and Analysis, University of California, April 1969.

One of the problems in predicting costs on the basis of input/output models is that the coefficients may change. The author investigates the hypothesis that faculty workload parameters are relatively stable over time. While some coefficients were stable and others displayed stable trends, the majority fluctuated with annual changes as high as 200 per cent. Comparison of the stability of coefficients for Engineering students and those for students of a small department, such as Statistics, suggests that aggregate figures are not necessarily more stable than departmental figures.

Brovender, S. *Interactions Between Departments and Programs in Analyzing a University*. Ann Arbor, Michigan: University Microfilms, 1970.

Using an input/output matrix, the author calculates coefficients of a student flow model for the University of Pittsburgh. Several samples are used in order to test the stability of these coefficients.

Coffelt, John J. *Faculty Teaching Loads and Student-Credit-Hour Costs*. Oklahoma City: Oklahoma State Regents for Higher Education, January 1968.

A faculty salary cost study for the academic year 1966-67. Costs per student credit hour (semester credit hours) by course level, department, and discipline grouping are given for eight institutions. Graduate level costs are not broken down between Master's and Doctorate.

Colorado Commission on Higher Education. *Class Sizes, Teaching Loads, Instructional Salary Costs, 1965-66*. Denver, July 1968.

A faculty salary cost study for the academic year 1965-66. Faculty salary costs per student credit hour by level of course and by department for eight campuses are presented.

Doi, James I. "The Analysis of Class Size, Teaching Load and Instructional Salary Costs," *College Self Study*. Lectures on Institutional Research given at Stanford University July 19-25, 1959. Boulder, Colorado: Western Interstate Commission for Higher Education, 1959.

The author discusses the purposes and procedures of workload and instructional cost studies. In summarizing basic types of faculty workload studies, the author points out that teaching or instructional load cost studies can be obtained from institutional reports on hours taught, while total service load studies require questionnaires and involve all of the problems typical of faculty activity analysis. With reference to various kinds of direct cost study, the author discusses output unit measures used, basic factors for classifying data, various measures of the scope of programs of instruction, and alternative means of arraying cost study data for various purposes.

Hamelman, Paul W. "Analysis of Policy Alternatives for Higher Education: A Case Study." Blacksburg: Virginia Polytechnic Institute, n.d. (Unpublished)

_____. "A Decision Framework for Colleges and Universities," *Pittsburgh Business Review*, Vol. 40, No. 7, July 1970, pp. 2-11.

_____. "Missions, Matrices and University Management," *Academy of Management Journal*, March 1970, pp. 35-47.

All sources discuss application of systems analysis techniques to higher education, particularly with regard to the level of detail of cost data, student classifications, and budgetary units in instructional programs. A Leontief-type input/output table is offered by the author as a means of developing degree program costs, as well as displaying several other types of cost of interest to university management and the relationships between these types of information.

Kettler, Raymond W. "The Analysis of Class Size, Teaching Load and Instructional Costs," *College Self Study*. Lectures on Institutional Research given at Stanford University July 19-25, 1959. Boulder, Colorado: Western Interstate Commission for Higher Education, 1959.

A cogent review of cost analysis studies from the early 30's to the late 50's. Factors which have been observed to affect the variability in costs as well as factors which unit cost information obscures are discussed.

Kobler, R. Dale. *Volume and Cost of Instructional Activity: Public Colleges and Universities in Colorado, Fall Term 1969*. Denver: Colorado Commission on Higher Education, March 1971.

This study shows faculty salary costs per student credit hour by discipline grouping for all public colleges and universities in Colorado. These are fall term only, 1969. In addition, the study shows various other data such as student credit hours produced, class sizes, full-time equivalent faculty, and distribution of teaching hours by rank and by department. Credit hour costs are shown by discipline grouping but are not broken down by level.

Kobler, R. Dale, and Gittings, Thomas A. *The Volume of Instructional Activity For the 1968-69 Academic Year and 1969 Summer Session.* Denver: Department of Education, Colorado Commission on Higher Education, December 1969.

Kobler, R. Dale; Walker, Charles R.; and Gittings, Thomas A. *The Volume of Instructional Activity, Fall Term 1968.* Denver: Colorado Commission on Higher Education, June 1969.

Both of the above are similar to the study by Kobler with the exception that costs per student credit hour are not given.

Lancaster, J. B. [Legislative Auditor of the State of Louisiana]. *Study of Faculty and Instructional Salary Costs at Louisiana State Colleges and Universities During the 1966-67 Academic Year.* Baton Rouge, 1968.

_____. *Study of Faculty and Instructional Salary Costs at Louisiana State Colleges and Universities During the 1967-68 Academic Year.* Baton Rouge, Louisiana, 1970.

These two studies are faculty salary cost studies for the academic years 1966-68. Costs per student credit hour by level of course and by discipline grouping are provided for sixteen campuses. Graduate level costs are broken down by Master's and Doctorate.

Langlois, Eleanor. *The Length of Time Spent in Earning the Ph.D. Degree at the University of California, Berkeley.* Berkeley: Office of Institutional Research, University of California, 1967.

> "[This study] focuses on one and only one aspect of graduate education: how long a period of time students have taken to earn a Doctor of Philosophy degree at Berkeley in the past few years. No values are imposed on the data and none have been drawn from them."
>
> "The present study guides the reader from the simple measurements of elapsed time and semester count to the complexities behind the measurements, and the reader should reserve judgment until he is acquainted with all of the material. My primary concern is that he does not too readily, and without sufficient evidence, infer that all short periods are to be recommended and all long periods condemned." (From the Foreword, p. ii.)

Leimkuhler, Ferdinand F., and Cooper, Michael D. *Cost Accounting and Analysis for University Libraries.* Paper P-2, Ford Foundation Research Projects in University Administration. Berkeley: Office of the Vice President--Planning and Analysis, University of California, January 1970.

This cost study specifies in great detail the direct costs of library operation, including capital costs. Indirect costs are allocated on a simple 10 per cent of wages and salaries basis. Offices within libraries are allocated on the basis of salary percentages. Then service flows are observed to allocate costs of service centers.

Marshall, Kneale T., and Oliver, Robert M. *A Constant Work Model for Student Attendance and Enrollment.* Research Report No. 69-1, Ford Foundation Research Projects in University Administration. Berkeley: Office of the Vice President--Planning and Analysis, University of California, February 1969.

_____, and Suslow, S. S. *Undergraduate Enrollments and Attendance Patterns.* Report No. 4, Administrative Studies Project in Higher Education. Berkeley: University of California, March 1970.

Both sources are concerned with estimating characteristics of student flow. Enrollment attendance, and dropout patterns in the University of California are investigated.

Michigan Council of State College Presidents. *Unit Cost Study, Instruction and Departmental Research, 1966-67: A Study for the Public Colleges and Universities in Michigan.* Lansing, December 1968.

_____. *Unit Cost Study, Instruction and Departmental Research, 1968-69: A Study for the Public Colleges and Universities in Michigan.* Lansing, October 1970.

These studies present faculty salary costs and direct instructional costs per student credit hour by department for eleven campuses for the academic years 1966-68. Student credit hour costs are presented in some instances on both a quarter credit hour and semester credit hour basis, where quarter credit hour is defined as three halves times semester credit hour. (Quarter credit hour = $\frac{3}{2}$ times semester credit hour.) Costs are broken down by level of student and graduate level costs are broken down to Master's and Doctorate levels.

New Mexico Board of Educational Finance. *Class Size, Teaching Loads and Instructional Salary Costs Data for Regular Academic Year 1960-61, New Mexico State Educational Institutions of Higher Education.* Santa Fe, February 1962.

This report is a faculty salary study of costs per student credit hour by course level and by department for seven campuses during the academic year, 1960-61.

Quatman, Gerald L. *The Cost of Providing Library Services to Groups in the Purdue University Community--1961.* Lafayette, Indiana: Purdue University Libraries, June 1962.

The purpose of this study is to determine the average costs of providing library service and facilities to members of the university community engaged in research supported by organizations outside of the university. The study takes the actual use approach in measuring library use costs. Library costs are distributed to undergraduates, graduate students, faculty members and others on the basis of a survey of actual usage.

Siegel, Barry N. "Costing Students in Higher Education: A Case Study." Eugene: The Center for the Advanced Study of Educational Administration, University of Oregon, August 1967. (Unpublished)

Faculty salary costs per FTE student by level of student for discipline groupings and for fall quarters 1964-66. Graduate level costs are broken down between Master's and Doctorate levels.

Tennessee Higher Education Commission. "Instructional Legislative Appropriation Request for 1971-72." Nashville. (Unpublished)

A direct instructional cost study for the academic year 1969-70. Costs are presented per student credit hour and full-time equivalent student by level of course and by discipline grouping. Costs are broken down at the graduate level to Master's and Doctorate levels.

Terman, Frederick E., and Reeling, Gelnn E. *Engineering Education in New York*. Albany: The State Education Department, The University of the State of New York, March 1969.

This report contains a faculty salary study for the academic year 1967-68 of costs per student credit hour in Engineering on twenty-three campuses in New York. Costs are not differentiated by level.

Texas College and University System. Coordinating Board. "Definitions of the Elements of Institutional Costs," *CB Report*, Vol. V., No. 3. Austin, March 1970.

A faculty salary cost forecast for the academic years 1970-73. Costs per student credit hour by level of course for nineteen campuses are given. Costs are not broken down by department, but graduate level costs are broken down between Master's and Doctorate levels.

Thompson, Robert K. "How Does the Faculty Spend Its Time?" The Distribution of Faculty Effort at the University of Washington and Comparable Universities. *University of Washington Report*. Seattle: University of Washington, February 25, 1971.

An examination of the distribution of faculty time between graduate and undergraduate teaching and the comparison of this with distributions from other major western public institutions.

Thrash, E. E. *Statistical Summaries 1969-70*. A presentation of operational finances and other pertinant data at the universities and state colleges. Jackson: The Board of Trustees of Institutions of Higher Learning, State of Mississippi, January 1970.

A faculty salary cost study for the fiscal year 1969-70. Program totals for seven campuses are given. Costs are not averaged over any output measures and there is no distinction of costs according to level or department.

University of California. "Faculty Effort and Output Study." Memo to members of the Committee on Educational Policy. Berkeley: Office of the Vice President--Planning and Analysis, January 9, 1970. (Unpublished)

_____. "Survey of Faculty Effort and Output." Berkeley: Office of the Vice President--Planning and Analysis, April 1969. (Unpublished)

This faculty effort survey is one of few which assess both the nature of outputs produced by various activities and their use within the institution.

University of Colorado. "Historical Summary--Class Size, Teaching Load, and Instructional Salary Cost Data." Boulder: Office of Institutional Research, n.d. (Unpublished)

A faculty salary cost study for the academic years 1957-1968. Costs per student credit hour by level of course and by department are presented. Graduate level costs are not broken down into Master's and Doctorate levels.

_____. *Scale--Summary of Cost and Load Evaluation, Academic Year 1968-69*. Boulder, May 1970.

A faculty salary study for the academic year 1968-69. Costs per student credit hour by department, both by level of student and level of course, are presented. Graduate level costs are not differentiated between Master's and Doctorate levels.

University of Michigan. *Some Quantitative Measures of Instructional Productivity and Direct Costs in the Schools and Colleges--Fall Semester, 1961-1962*. Operations Analysis Report Series. Ann Arbor: Office of the Vice President for Academic Affairs, June 1962.

A direct instructional cost study for fall semester 1961-62. Costs per student credit hour and full-time equivalent student by level of course and by department are presented. Graduate level costs are broken down according to Master's and Doctorate levels.

University of Nebraska. *Analysis of Course Offerings, Class Size, Teaching Load, and Credit Hour Costs, the University of Nebraska Lincoln Campuses and the University of Nebraska at Omaha, First Semester 1969-1970*. Lincoln: Office of Institutional Research and Planning, May 1970.

Faculty salary costs per student credit hour, fall semester 1969-70, by discipline grouping.

Walker, Charles R., and Coffelt, John J. *Financing Current Operating Costs of Higher Education in Oklahoma*. Report No. 4, Self-Study of Higher Education in Oklahoma. Oklahoma City: Oklahoma State Regents for Higher Education, March 1963.

A faculty salary cost study for the fiscal year 1961-62. Costs per student credit hour by level of course are presented for ten institutions. Costs are not broken down by discipline groupings or departments and graduate level costs are not broken down to Master's and Doctorate levels.

Weiler, William C. "A Description of the Minnesota Cost Development Model." Minneapolis: Analytical Studies Group, Graduate School Research Center, University of Minnesota. (Unpublished)

"This model calculates average expenditures per student credit hour under alternative definitions of what to include in costs. These alternatives can include all, or any combination of the following costs: instructional salary costs (which include teaching associates); support costs (which include supplies, departmental and college administration costs and salaries of paper graders); and current plant maintenance expense. Because of this flexibility, the MCDM can be used to provide data which are consistent with cost data from other institutions." (From the author's introduction on page 1.)

4.2 Full Cost Studies

American Association of Colleges of Pharmacy. *A Study of Program Costs, Facility Needs, and Faculty Requirements of Schools of Pharmacy, 1967-69*. Edited by David S. Newton. Silver Spring, Maryland, 1969.

A full cost study using faculty effort reports for purposes of allocations for thirty institutions per FTE student by level in the Colleges of Pharmacy. Characteristics of the distributions of costs are also given, as well as the relationship between costs and type of institutional ownership and type of program.

Association of Independent California Colleges and Universities. *1970 Statistical Profile, Independent California Colleges and Universities*. A report to the Joint Committee on Higher Education, California State Legislature. Los Angeles, March 1970.

This report contains a presentation of full costs derived according to the "Simplistic" procedure described in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*, for the fiscal year 1968-69. Costs per FTE student by campus for 43 campuses are presented.

Bartram, John W. "Study of Educational and General Expenditure Per F.T.E. Student By Level for 1966-67." Memo to Administrative Budget Committee. Boulder: University of Colorado, December 1, 1967. (Unpublished)

In this study full costs are derived by the "Simplistic" procedure described in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*. Costs per FTE student by level of student are presented for the academic year 1966-67 on a campus-wide basis.

Black, Martin L., Jr., and Eversole, Harold B. *Report on Cost Accounting in Industry*. Washington, D. C.: U. S. Office of Price Administration, June 1946.

A study of techniques used by industries within the jurisdiction of the Office of Price Administration during World War II for allocating indirect costs. Unfortunately, there is no summary of techniques and one has to look up each product's category to determine what methods are used. Among the general conclusions of the report are that several proxies are used for support service use and that, in general more care is paid to cost allocation in companies with multiple product lines.

Blumberg, Mark S., and Wing, Paul. "Operating Expenditures and Sponsored Research at U. S. Medical Schools: An Empirical Study of Cost Patterns." Berkeley: Office of Health Planning, Office of the President, University of California, Revised March 20, 1970. (Unpublished)

Use of regression analysis in cost allocation using medical schools as the subject. Specific objectives of the study are to determine program costs for each of the major educational programs in U. S. medical schools, to investigate economies of scale in medical undergraduate education, and to explore the relationship between educational programs and research.

Campbell, Thomas J. *Program Cost Allocation in Seven Medical Centers: A Pilot Study*. Washington, D. C.: Association of American Medical Colleges and U. S. Department of Health, Education, and Welfare, 1969.

A cost study involving seven medical centers. Each participating center was asked to compare its present cost procedures with the recommended one and to comment on indirect cost rates--including the rates developed by procedures outlined in Bureau of the Budget, Circular A-21, for medical schools--to comment on cost sharing, and to comment on time or effort reporting. While details of the study are not applicable to the majority of graduate education programs in institutions of higher education, they do have several elements in common, including types of faculty effort report and proxies for distributing costs of supporting units to organizational units which draw on their services.

Culpepper, J. B. *Current Operating Expenditures by Function, 1958-59, 1959-60*. Tallahassee: Board of Control, The State University System of Florida, 1961.

_____. *Current Operating Expenditures by Function, 1962-63, 1963-64*. Tallahassee: Board of Regents, The State University System of Florida, 1966.

Both of the above studies give full costs per full-time equivalent student by level of course and discipline grouping for fifteen campuses in the Florida State system. Graduate level costs are not broken down between Master's and Doctorate. Summer session

costs are included. The procedure used to allocate indirect costs is a variation of the "Recursive" procedure described in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*. A full description of allocation procedures is contained in Florida Cost Study Committee and the Office of the State Board of Control, "A Manual for Analyzing University Expenditures by Function," Revised 1969-70, Tallahassee, Florida, (Unpublished).

Duxbury, David A. *Cost Study Manual, 1965-66*. Springfield: Illinois Board of Higher Education, December 1966.

A cost study manual recommending indirect cost allocation procedures which are described as "Direct" in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*. Programs and steps in carrying out a cost study are defined explicitly. Instructional salary costs are allocated to courses and then distributed to student credit hours by level of enrolled student. Then, costs per level are totaled for each department. Faculty salary dollars are then used as a base for allocation of most other costs. The study includes a sample faculty effort report which requires distribution of faculty effort to nine categories of departmental activity.

Evans, John M. "Accounting's Progressive Primary Use Plan," *College and University Business*, Vol. 16, No. 1, 1966, pp. 23-7.

A five-step plan for allocating indirect costs to instructional output. This plan is similar in principle although not quite as extensive as the indirect cost allocation procedure described as "Recursive" in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*.

_____. "Here's How to Go About Finding the Total Cost of Educational Programs," *College and University Business*, Vol. 17, September 1954, pp. 41-5.

An earlier version of the indirect cost allocation procedure described in "Accounting's Progressive Primary Use Plan," also by Evans.

Ewald, A. A., and Kiker, B. V. "A Model for Determining the Input Cost of University Degrees," *Socio-Economic Planning Sciences*, Vol. 4, 1970, pp. 331-40.

The authors propose an indirect cost allocation procedure similar to the "General Solution Formula" described in Appendix A to Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*. However, the methodology restricts reciprocal interactions between Primary and Support activities.

Florida Cost Study Committee and the Office of the State Board of Control. "A Manual for Analyzing University Expenditures by Function." Revised 1959-60. Tallahassee, Florida. (Unpublished)

This report provides a uniform methodology used for calculating full costs per full-time equivalent student for campuses of the Florida State university system. The core of the procedure

for allocating direct costs of instruction is a faculty effort report. Instructional salaries are then used as a basis for allocating department overheads. Total expenditures thus generated are then used as the basis for allocating school overheads, which include Dean's Office expenditures. In general, the principle for distributing costs of support units is on the basis of the previously allocated costs of user programs as a percentage of total previously allocated costs. Plant Operations and Maintenance costs are allocated on the basis of square feet. The manual includes a space survey procedure.

Grinter, L. E. "Costs of Graduate and Undergraduate Education." Gainesville: University of Florida, Self Study Office, January 12, 1969. (Unpublished)

The study concentrates on using national data on expenditures of higher education and enrollment in order to obtain average costs of graduate education and undergraduate education per FTE student. Where national data were missing, those from the University of Florida were used on the assumption that the University of Florida is reasonably typical of the broadly-developed institutions that produce a high percentage of advanced degrees. The study includes 75 per cent of all organized research expenditures from the U. S. Office of Education, *Digest of Educational Statistics, 1967*, as being part of the expenses of graduate education. Twenty-five per cent of organized research expenditures are assumed to be service-oriented. The study concludes that on the average it costs ten times as much to educate a graduate student as an undergraduate student and that for Ph.D.'s the factor may be 15, while for M.A.'s it may be as low as 7.5. It also concludes that costs of education in a science area are approximately twice that in non-science areas.

Hagen, Vern C. "Program Budgeting for Higher Education in New Mexico--A Pilot Study," *Planning--Programming--Budgeting in New Mexico*. Albuquerque, 1970.

This study first defines existing budgetary units at the University of New Mexico in terms of the primary or support producing nature of the outputs and services they provide, and then uses this format to conduct a pilot study to estimate costs. Using the "Direct" allocation procedure described in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*, the study develops full costs per student contact hour by level of student and by level of course for four departments in Fall Quarter 1969. Graduate level costs are broken down between Master's and Doctorate levels.

Hirschl, Harry Hamel. "Some Economic Considerations and a Procedure for a University Cost Study." Unpublished Master's Thesis. Lafayette, Indiana: Purdue University, June 1965.

A brief discussion of the micro-economics of university operation and description of a methodology for determining full costs of instructional outputs. The procedure used for allocation of indirect cost is that described as "Recursive" in Chapter 5 of

Elements Related to the Determination of Costs and Benefits of Graduate Education. Some research expenses are allocated to instruction. The procedure used here is to allocate unrecovered costs of sponsored research to instruction, which is the procedure described as Alternative 2 in Chapter 7 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*.

Hull, L. E., and McWhirter, D. A. *Unit Cost Analysis Procedure--Indiana University*. Bloomington: Indiana University Foundation, 1964.

This cost study manual evolved from the 1947 state legislature mandate requiring state-supported universities to submit funding requests jointly and to substantiate requests by scientific analysis of past expenditures. The study involves the use of the indirect cost allocation procedure described as "Direct" in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*. Detailed instructions are given for distribution of activity costs to primary programs. Apparently this study was used as the basis for cost calculations in Indiana up to the 1966-67 academic year.

Illinois Board of Higher Education. "A Unit Cost Study Manual for Nonpublic Institutions of Higher Education in Illinois." Chicago, August 1969. (Unpublished)

_____. "Supplement to A Unit Cost Study Manual for Nonpublic Institutions of Higher Education in Illinois." Chicago, August 1969. (Unpublished)

This manual involves the use of the indirect cost allocation procedure described as "Direct" in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*. Costs are allocated to semester credit hours by level of class for four levels. The study also involves use of a faculty effort report involving distribution of faculty salaries to nine universities. Explicit steps for completing the allocation are described. Most costs are allocated on the basis of total operating expenditures with the following exceptions: General administrative services and faculty and staff services and college and departmental administration costs are allocated on the basis of total instructional costs; student services are allocated on the basis of academic salaries.

Iowa State University of Science and Technology. "Institutional Cost Analysis, 1968-69." Ames, n.d. (Unpublished)

Using the "Simplistic" allocation procedure described in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*, this study derives full costs per FTE student by level of course for the academic year 1962-1969. Costs are not broken down by department or discipline grouping, but are broken down between Master's and Doctorate levels at the graduate level.

Keene, T. Wayne. *Program Cost Differentials at the University of South Florida, 1965-66*. Tampa: Division of Planning and Analysis, University of South Florida, March 1968.

_____. *Program Cost Differentials at the University of South Florida, 1966-67*. Tampa: Division of Planning and Analysis, University of South Florida, June 1969.

These studies provide faculty salary costs, instructional costs and full costs, using the "Direct" allocation procedure

described in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*. Costs per full-time equivalent student by department and level of course are presented for the academic year 1965-67 for one campus. Graduate level costs are not broken down by Master's and Doctorate. The core of the study was a faculty per cent of time report.

Knott, Leslie W., M.D.: Vreeland, Ellwynne M., R.N.: and Gooch, Marjorie, Sc.D. *Cost Analysis for Collegiate Programs in Nursing, Part I (Analysis of Expenditures), and Part II (Current Income and Other Resources)*. New York: National League for Nursing, Division of Nursing Education, 1956 and 1957.

A manual to aid universities, colleges, hospitals and associated agencies in determining costs of nursing education. This manual is especially helpful in identifying available procedures for allocating indirect costs.

National Committee on Standard Reports for Institutions of Higher Education. *Financial Reports for Colleges and Universities*. Chicago, Illinois: University of Chicago Press, 1935.

A comprehensive manual for determining full costs of instructional outputs on a uniform basis. The indirect cost allocation procedure used is the procedure described as "Direct" in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*.

_____. *A Study of Methods Used in Unit-Cost Studies in Higher Education*. Bulletin No. 3. Chicago, Illinois, 1932.

A thorough study of techniques used for allocating indirect costs, as well as the bases used for distributing costs of one organizational unit to the units using its services. Tables showing the frequency of use of various procedures and measures are included.

Ohio Board of Regents. "Actual Institutional and General Expenditures Per F.T.E. 1968-1969." Columbus, n.d. (Unpublished)

_____. "1969-70 Budgeted Expenditures Per F.T.E." Columbus, n.d. (Unpublished)

Both studies are full cost studies using the "Direct" procedure for allocating indirect costs as described in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*. Costs per full-time equivalent student for the fiscal years 1968-70 are presented for twelve campuses. Costs are not broken down by discipline grouping or department, but are broken down by level. Graduate level costs are broken down by Master's and Doctorate levels. Both studies are based on procedures outlined in Ohio Board of Regents, *Resource Analysis Procedures*, Uniform Information System, Columbus, n.d.

_____. *Resource Analysis Procedures*. Uniform Information System. Columbus, n.d.

A manual describing the uniform procedure for determining full costs of higher education instructional outputs in Ohio. The procedure described may be classified as the "Direct" procedure described in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*.

Peat, Marwick, Mitchell, and Company. "Variations in Research Indirect Cost Rates: A Study of Six Universities." New York, February 14, 1969. (Unpublished)

A questionnaire approach was used to sample the use of research indirect cost rates at six universities. Among the findings were: (1) that universities were not profiting unfairly from federally-sponsored research projects; and (2) that the main cause of rate difference is the result of the decision to treat a particular type of activity as either a direct or indirect cost. The six universities studied were Princeton, Stanford, Columbia, Iowa State, University of Michigan, and Louisiana State. The authors found that rate computations varied in the selection of activities to be charged directly to projects, selection of the basis for distribution of indirect costs, construction of indirect cost pools, selection of units of measure, differences in cost level of indirect functions, results of audit, and negotiation. One conclusion of the study was that institutions do have flexibility in changing costing methods and that some standardization is probably feasible. As a practical matter, the study finds, the more activites that are charged directly to research, the lower will be the resulting indirect cost rate and the higher will be the total cost recovery rate.

Perch, T. James [Director]. "A Cost and Profitability Analysis." Bronx, New York: Office of Institutional Research, Manhattan College, June 1968. (Unpublished)

Using the "Simplistic" procedure for allocating indirect costs described in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*, this study determines full costs per student credit hour, per FTE student, and per degree for the academic year 1967-68. Costs are broken down by department. For determining student credit hour costs, level of course was used; for determining degree costs, level of student was used. The study also contains the direct instructional costs only for the units described. Also, a comparison of costs with institutional revenues is made.

Purdue University. "Summary Report: 1968-69 Cost Study." Lafayette, Indiana: Institutional Cost Studies, October 1970. (Unpublished)

Tuition and full costs per composite registration enrollment (composite registration is a weighted average of fall, spring and summer session registration) by level of student on an all-campus basis and by discipline grouping on an all-student basis.

Rust, Jerry H. *The Cost of Collegiate Nursing Education in Tennessee.* Nashville: Tennessee Higher Education Commission, 1969.

A full cost study of nursing degrees in Tennessee. Costs per degree on twelve campuses for the fiscal year 1967-68 are presented. While not concerned with costs of graduate education, this study is one of the few to use the "Recursive" procedure to allocate indirect costs as described in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education.*

Stevens, Edwin B., and Elliott, Edward C. *Unit Costs of Higher Education.* Reviewed and presented by the Educational Finance Inquiry Commission under the auspices of the American Council on Education. New York: The MacMillan Company, March 1925.

An early and thorough average cost study conducted by state universities in the Pacific Northwest. In addition to data for several northwestern state universities, this study also contains data for Purdue, Yale, and the University of Pennsylvania. A detailed description of a technique for the classification of institutional expenditures and relation of these expenditures to services provided is presented.

Technical Committee on Costs of Higher Education in California. *The Costs of Higher Education in California, 1960-75.* Report prepared for the Master Plan Survey Team and the Liaison Committee of The Regents of the University of California and The State Board of Education. Berkeley and Sacramento, January 1960.

A full cost study using the "Direct" procedure to allocate indirect costs as described in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education.* Costs per student credit hour for sixteen campuses are presented for the academic year 1957-58. Costs are not broken down by department or level.

U. S. Department of Health, Education, and Welfare. Social and Rehabilitation Service. *The Cost and Output of Graduate Social Work Education: An Exploratory Study.* Washington, D. C., April 1970.

A lengthy study of the nature and cost of social work education programs at four pilot schools. In addition to cost structure, the study investigates the decision process in the pilot schools and finds the lack of well-defined objectives makes modeling the process of decisions concerning admissions, curriculum, and program policy impossible. The study urges adoption of a production process concept by decision makers in the field.

University of Hawaii. "Instructional Unit Cost Study, Year Ended June 30, 1969." Honolulu, 1969. (Unpublished)

A full cost study using the procedure described as "Direct" in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education,* to allocate indirect costs. Costs per student credit hour by level of course and by discipline grouping are presented for the fiscal year 1968-69. Graduate level costs are not differentiated according to Master's or Doctorate levels. The study also contains faculty salary costs and direct instructional costs, as well as full costs.

University of Nevada. *University of Nevada System, Cost of Instruction, 1968-69.* Reno, n.d.

A full cost study using the indirect cost allocation procedure described as "Simplistic" in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education.* Costs per student credit hour and full-time equivalent student by level of course, by department, by college, by university, and by statewide system are presented for two campuses. Graduate level costs are not broken down to Master's and Doctorate levels. The document also displays direct instructional costs.

Van Dyke, George E. *A Study of Methods Used in Unit Cost Studies in Higher Education*. Bulletin No. 3. Chicago, Illinois: National Committee on Standard Reports for Institutions of Higher Education, 1932.

This study summarizes and classifies a number of studies carried on in state-controlled institutions up to 1930 according to type of unit used to allocate, type of unit allocated to, type of expenditure allocated, and method of allocation. After examining 45 cost studies, the author concludes that valid comparisons of unit costs could not be made between different institutions because of the very great differences in the units employed, classification of expenditures, and methods of allocating expenditures. These differences, conclude the author, point to an urgent need for a recognized technique for the computation of unit costs if costs are to have any value outside the individual institutions in which they are calculated.

Williams, Robert L. "The Cost of Educating One College Student," *The Educational Record*, Vol. XXXII, October 1961, pp. 322-9.

A description of the direct and indirect cost allocation procedures in use at Michigan in 1961. The allocation procedure described is that identified as "Direct" in Chapter 5 of *Elements Related to the Determination of Costs and Benefits of Graduate Education*.

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